MANUAL OF THE VERTEBRATE ANIMALS

DAVID STARR JORDAN

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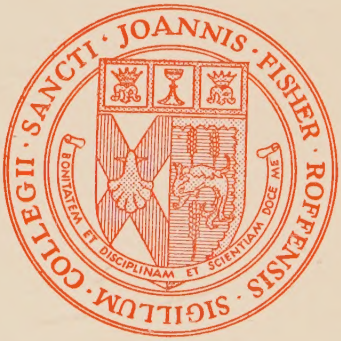

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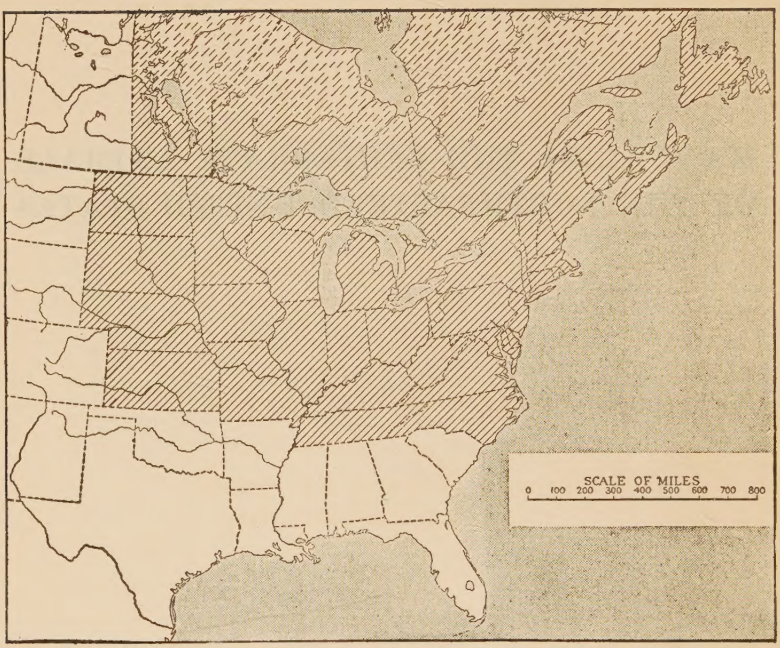
MANUAL OF THE VERTEBRATE ANIMALS OF THE NORTHEASTERN UNITED STATES



Map showing the approximate region covered in this book. The shaded portion represents the area within which all vertebrate species are described. In the area outside the shaded portion only those species are described which overlap the main area. The broken shading to the north indicates that there is no fixed limit in this direction.

Manual of the
VERTEBRATE ANIMALS
of the Northeastern United States
INCLUSIVE OF MARINE SPECIES

By David Starr Jordan
Chancellor Emeritus of
Leland Stanford Junior University

WITH AN INTRODUCTION BY
Barton Warren Evermann
California Academy of Sciences

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FOR over fifty years the scientific world has been familiar with Dr. Jordan's *Manual of the Vertebrates;* and many a scientist, now middle-aged, proudly asserts that he "was brought up on it." After going through twelve editions the work has now been given a thorough revision, new features have been added, and the Manual becomes practically a new book. No expense or time has been spared to make it thoroughly accurate and up to date. World Book Company believes that by taking over the publication of this monumental work of Dr. Jordan's in its revised form, it will be doing the world of science a signal service, and incidentally carrying out its motto, "Books that apply the world's knowledge to the world's needs."

JMV–1

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TO FIVE OF MY EARLY STUDENTS, "BROUGHT UP ON THE MANUAL OF THE VERTEBRATES":

CHARLES HENRY GILBERT
BARTON WARREN EVERMANN
CARL H. EIGENMANN
WILLIS STANLEY BLATCHLEY
OLIVER PEEBLES JENKINS

AND TO FIVE OTHERS, EQUALLY GIFTED, WHO LOST THEIR LIVES WHILE ENGAGED IN FIELD WORK:

HERBERT EDSON COPELAND
CHARLES LESLIE McKAY
CHARLES HARVEY BOLLMAN
SETH EUGENE MEEK
ERIC KNIGHT JORDAN

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PREFATORY NOTE

In the year 1874, while the author was a young teacher in Wisconsin, he found that, except among the birds, it was quite impossible to identify correctly most of the backboned animals with which he became acquainted. He believed that the open door to zoölogy and botany, and the only source of accurate knowledge of geographical distribution and the origin of species, lies through the discrimination of the different kinds as they exist in nature. With this thought, after the fashion of Gray's *Manual of Botany*, he prepared a volume called *A Manual of Vertebrates*, by which students and collectors could identify the backboned animals about them and could recognize the characters on which families, genera, and species are founded.

The first edition was published by Jansen, McClurg & Co. in 1876. In 1888, the demand for a fifth edition led the author to revise the work, laying less stress on artificial characters and beginning the series with the lowest instead of the most specialized or highest forms of the series. This fifth impression was practically rewritten. The succeeding editions (sixth to twelfth) differed from it in such alterations as could be made in the plates. The present edition, under new auspices, — the copyright having been transferred from A. C. McClurg & Co. to World Book Company, — has again been thoroughly revised and entirely reset.

The district covered is, approximately, the northeastern United States and southern Canada, extending from Labrador westward to and including Manitoba and North Dakota, and southward to and including North Carolina and Kansas (see map, page ii). The resident shore fishes of the region are included, but for the most part not the strays from the Gulf Stream or the fishes of the Deep Seas. The birds which are chance wanderers from Europe or the West Indies are also omitted or, at the most, merely mentioned.

It will be noticed that the number of genera recognized has been considerably increased in the last forty years. This is connected with the acceptance of the conception of divergent evolution, now adopted by all serious students of animal and plant life. Analysis must precede synthesis, and it is better to lay stress on aberrant forms rather than to include these uncritically in expanded groups, the definition of which is impaired or denied by their presence. Investigators who desire to be more "conservative" will find the process simple. In modern classification, a genus is no longer a convenient receptacle into which a suitable

number of species are thrown. It represents rather a step in evolutionary divergence, and each definable fork is set off as a genus. An aggregation of such steps leading in different directions can no longer be defined as a "genus."

Beginning with 1758, the date of Linnaeus's *Systema Naturae*, for sixty years a genus was usually regarded merely as a sort of pigeonhole into which might be tucked or grouped similar species, with no thought as to origin or relations, and little discrimination between analogies and homologies. With Cuvier's *Règne Animal* (1817) came the conception of "arrangement of the animal kingdom, according to organization," or comparative anatomy. With Darwin's *Origin of Species*, forty years later (1859), zoölogists began, though slowly at first, to realize that a classification must be more than an inventory; that its basis must be genetic; and that the problems involved in a natural grouping are vastly more complex than even great morphologists like Cuvier and Agassiz had realized. To paraphrase a saying of Elliott Coues, genera and species are but larger and smaller twigs of a tree which we try to arrange as nearly as possible in accordance with nature's ramifications. This view applied to taxonomy involves the extensive subdivision of accepted genera, many of which were unnatural in the highest degree, a subdivision in some cases doubtless going too far; but our material must be first analyzed before we can group its parts in natural order. No system of naming can progress beyond the knowledge on which it rests.

I may repeat a warning as old as science itself, attributed indeed to Aristotle, that we must not expect a degree of accuracy which the subject in question does not permit.

In the advance of biological science induced by the development of our knowledge of evolution of forms, the chief workers are separated into three groups, which I may call the observers, the experimenters, and the philosophers. The first group, with Darwin as the leader, have studied nature in the field, the varied phenomena developing each in its own way, a cause behind each one. The experimenters have in one way or another varied the conditions of life, producing results in some degree parallel with those seen in nature, but occupying much less time in the process and sometimes overlooking the actual workings as shown in nature. The philosophers, accepting and often understanding the results of observation and experiment, deduce from them various conclusions, varying with their tastes or their abilities.

A species of animal or plant may be regarded as a definable category of

individuals which have *run the gantlet of life* and *have endured.* A "creation," to use a current florists' term, is an offshoot from a species, based on individual variation more or less marked, preserved, and enhanced through artificial selection, and often modified by hybridization. Such forms are not certain to endure in the gantlet of life, because of their likelihood of being submerged in the mass, and often through lack of adaptation and inability to maintain themselves in competition. The individuals of the mass, each varying in minor matters, are on the whole prepotent as against large variations or "mutations" (although these are not rare in nature), because the members of the mass have been rigidly selected, are backed by long heredity, and are supported by force of numbers.

There are two features which have often been overlooked, although they are almost universal among species of animals and plants. The first, which has been called Jordan's Law (1904), is indicated as follows:

> Given any species in any region, its nearest related (geminate or twin) form is not to be found in the same region or in any remote region, but in a neighboring district separated from the first by a barrier of some sort, or at least by a barrier of country, the breadth of which gives the effect of a barrier.

The other is that the distinctions between nearly related species are practically never features of utility. The most permanent characters are those which do not visibly contribute to the welfare of the plant or animal. Useful characters change most quickly as they fall into the grasp of selection.

Although much has been written on the origin of species by "mutation," by the slow accumulation of small but useful variations, and by Mendelian hybridism, there is no evidence favoring any of these theories to be drawn from American vertebrates. Most of our species are plainly related to geographical influences, or rather obstacles. The presence of barriers of mountain, sea, prairie, or desert, or of climate, food, or enemies, limits the range of forms. The descendants of individuals which cross a barrier in time develop traits of their own, and these in time serve to define a species or subspecies, which is a species in the making. The idea that a "true species" is defined as one in which hybrids are sterile has no foundation as a general proposition. The more nearly related two species may be, in the process of evolution, the more likely they are to form fertile hybrids. But hybrids of any sort are rare in nature. In the American fauna a few cases are recorded among certain warblers, darters, sunfish, and snappers, perhaps a dozen in all, and nothing is known as to their fertility.

The term "biology" is now rarely used as the equivalent of "zoölogy" and "botany," but more freely in a collective sense as a study of the features common to both. Stress is laid on agreements on life cycles rather than on features distinctive of each. The study of animals and plants as they are tends to being replaced by experiment and resultant theory.

This adjustment has the advantage of helping us to know our "brother organisms" in a world otherwise lifeless, as well as to place in the student's hands that "knowledge which is worth most," in the view of Herbert Spencer. This is the knowledge of life and of its culmination in ourselves.

The study of biology as a whole has, however, this disadvantage in the scheme of training: it is prone to give "information without contact," one of the banes of education. By giving broader views, the intensity of personal observation and induction is dimmed and the charm of outdoor research is lost.

The study of individual animals and plants as we find them about us is the natural beginning of a love of nature. It leads at last to a clearer insight into the essential unity of living things and to the recognition that each in its different way strives toward like results. "The book of nature is always open," as Agassiz used to say, "and all that I can do will be to lead pupils to study that book and not to pin their faith to any other."

As this volume is of little service without specimens in hand, and as its value is not confined to finding names or matching pictures, it is believed that it will continue to be useful in the progress of zoölogical science.

David Starr Jordan

Stanford University
California

ACKNOWLEDGMENTS

In this present edition, completely revised and rewritten, I have tried to make use of all information available in bringing nomenclature and descriptions up to date. Most general sources of help are indicated in the various earlier editions of this work. In the present one I have been especially aided by the *Check-List of North American Mammals and Reptiles*, by Leonhard Stejneger and Thomas Barbour; by the *Catalogue of American Mammals*, by Gerritt S. Miller; by the successive supplements to the *List of Birds*, of the American Ornithologists' Union; and by the manuscripts of the second edition (1928) of the *Check-List of the Fishes of North America*, by Jordan and Evermann. For special suggestions in correspondence, I may especially thank Dr. Charles Wallace Richmond and Mr. Barton A. Bean, of the United States National Museum; Dr. Joseph Grinnell, of the University of California; and Professor John O. Snyder, of Stanford University. I may also thank Mr. Alfred O. Shedd, of World Book Company, for careful and intelligent editorial help throughout the work of preparing the volume for the press.

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D. S. J.

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INTRODUCTION

The first really great impetus to the study of vertebrate animals in America came as a result of the publication in 1872 of Coues's *Key to North American Birds*. The next came with the publication in 1876 of Jordan's *Manual of Vertebrates of the Northern United States*. Many, doubtless most, of the American ornithologists who were active in the study of birds during the last decades of the last century got their greatest initial enthusiasm through the use of Coues's *Key* in the identification of the specimens of birds which they collected or which came into their hands. But Coues's work was limited to birds.

Those interested in mammals, reptiles, amphibians, or fishes could find no convenient handbook by which they could identify any specimens they might obtain in those groups of animals. Jordan's *Manual* met this need admirably. A greater stimulus to the study of systematic zoölogy probably never occurred in any country than that which came to high school students and others in the eastern United States with the publication of that modest little handbook. It is doubtful if any other book has had more to do with the development and fostering of the natural history spirit in young students, or the making of real naturalists, or giving them an understanding of the facts upon which specific determinations of animals are based.

The only way in which *species* can be studied understandingly is through careful examination and comparing of actual specimens of different species. Reading in books about animals and plants cannot alone give any true conception of what is meant by species. Agassiz used to say: "If you study Nature in books, when you go out of doors you cannot find her." Books have their place, of course — a great and vital place, if anything original is to be accomplished or any large work to be done. To make a real contribution to knowledge, one must find at least what others have seen or thought. But books cannot lead; contact with nature must come first.

It may be noted that Spencer Fullerton Baird began, not with far-off principles of biology or intricacies of life mechanism, but with exact observation of the birds and other animals he found around him. His experience illustrates the normal way in which a biologist should be formed; namely, through the study of organisms as present entities alive and active, — or when dead, illustrating through their structure their relation to other forms and to their environment.

The sessions in the usual modern college or high school laboratory with microscope and scalpel, and with nothing else, if a student has not an overwhelming passion for science, rather deter him from scientific pursuits; they give no hint of the beauty and fragrance and joy and inspiration of forest, stream, and wayside; they open up no vistas of interest and pleasure to the average student; they are remembered chiefly by the disagreeable smells and messes of the workroom.

The recent agitation of the question of organic evolution provokes the query as to whether the teaching in the schools of the facts of evolution, and particularly of the meaning and origin of species, has been effective.

To understand what is meant by the "origin of species" it is necessary to have a clear conception of what is meant by the term "species" as applied to animals and plants.

The only way by which a student can understand the characters which distinguish one species or kind of animal from another, or to understand how one species is related to another, is through a comparison and study of actual specimens of the species concerned. Knowledge of the facts of organic evolution can be acquired only through a careful examination and study of structural characters as shown by specimens in hand; it cannot be acquired through reading about them.

The tendency in zoölogical and botanical studies in our schools and colleges in recent years has been away from animals and plants as organic entities. The student too often sees no more of the animal than he can see under a compound microscope; he rarely sees or handles or studies the whole animal; he almost never has an opportunity to examine and compare numerous specimens of different species or to identify different species.

A recent investigation of the courses of study in the high schools of an important state discloses the astonishing fact that botany was offered in only one per cent of the high schools of that state and that only twelve hundredths of one per cent of the students were taking zoölogy. Of the total enrollment, 9.5 per cent were taking "Biology" and 10.75 per cent were taking "General Science," whatever those terms may mean. Just what is included in each of those two categories was not disclosed, but it did not appear, and was not claimed, that any systematic zoölogy was involved. From this it appears that the children are passing through the high schools without making any study of the facts upon which the theory of organic evolution or the origin of species is based.

Is it any wonder that so many otherwise intelligent people do not believe

in evolution and that so many others who accept evolution do not really understand what it means?

As the author of this *Manual* has said elsewhere, this is not a criticism of the many able specialists who, in their various fields, through marvelous technique have opened up wonderful vistas of the mechanism of life, nor of those who deal with technical fragments or quantitative methods. It is only insisted that with such work the budding biologist cannot begin.

It is insisted that the intensive study of living things around us, carried on accurately with specimens in hand, is a means of grace to every scholar and a first and essential step in preparation for biological research. It is well also to remember that biologists deal with the whole realm of life, not to be seen in perspective from any single corner.

Barton Warren Evermann

California Academy of Sciences

THE VERTEBRATE ANIMALS OF THE NORTHEASTERN UNITED STATES

VERTEBRATA (The Vertebrates)

The Vertebrates are, in popular language, "animals with a backbone." They are distinguished from all other animals, says Professor Huxley, "by the circumstance that a transverse and vertical section of the body exhibits two cavities, completely separated from each other by a partition. The dorsal cavity contains the cerebrospinal nervous system; the ventral, the alimentary canal, the heart, and, usually, a double chain of ganglia, which passes under the name of the 'sympathetic.' A vertebrated animal may be devoid of articulated limbs, and it never possesses more than two pairs. These are always provided with an internal skeleton, to which the muscles moving the limbs are attached."

Modern researches have shown that, besides the ordinary "backboned animals," certain other creatures, formerly considered as Mollusks or Worms, are really degenerate forms of Vertebrates, and must be considered as members, or at least as associates, of this group. The resemblance to the other Vertebrates on the part of the forms in question is seen in their early or larval development, and scarcely at all in the adult condition. "Many of the species start in life with the promise of reaching a point high in the scale, but after a while they turn around, and, as one might say, pursue a downward course, which results in an adult which displays but few resemblances to the other vertebrates." (*J. S. Kingsley.*) These are the Tunicates or Ascidians, forming the Class or Province of *Urochordata*. The essential character of the *Vertebrata*, in the broad sense of the term, is now understood to be this: "The possession of a cellular cord, — the 'notochord,' — which runs underneath the central nervous system, and which in the higher forms is surrounded by the permanent vertebral column and skull, and is largely obliterated by the development of these structures. So the term *Chordata* is frequently employed as synonymous with *Vertebrata* in its wide sense." (*R. R. Wright.*)

Without further discussion of the *Vertebrata* or *Chordata* as a whole, we may proceed to the account of the several subordinate groups or classes. The existing forms may first be divided into about six primary groups, which have been called "provinces" by Professor Huxley. These are (I) the *Urochordata*, including the class *Tunicata;* (II) the *Hemichordata* or *Enteropneusta;* (III) the *Cephalochordata*, corresponding to the class *Leptocardii;* (IV) the *Ichthyopsida*, including the fish-classes of *Cyclostomi*, *Elasmobranchii*, *Holocephali*, and *Pisces*, with the transitional class of *Amphibia;* (V) the *Sauropsida*, including the *Reptilia* and *Aves;* and finally (VI) the *Mammalia*, corresponding to the single class of the same name.

The relations of these classes are shown in the following analysis. Only the more obvious characters are here mentioned; others may be found in works on Comparative Anatomy.

Analysis of the Classes of Chordata

a. Anterior end of the central nervous axis not dilated into a brain and not surrounded by a protective capsule or skull.

b. Notochord confined to the tail and usually present only in the tadpole-like larval stage of the animal (*Urochordata*): adult animal not fish-like nor worm-like, its body invested with a tough envelope or "tunic." . . . . . TUNICATA.

bb. Notochord not confined to the tail, but extending forward to the anterior end of the body; sides of body with numerous gill slits which are persistent through life.

c. Notochord developed in anterior end of body only (*Hemichordata*): adult animal worm-like, without trace of fins; a long proboscis before the mouth. . ENTEROPNEUSTA.

cc. Notochord perfect, continued forward to a point before the mouth (*Cephalochordata*): body elongate, lanceolate, somewhat fish-like in form, not worm-like nor enveloped in a "tunic"; middle line of body with rudimentary fins; no proboscis; the mouth slit-like, fringed with cirri. . . . . LEPTOCARDII, A.

aa. Anterior end of the nervous axis dilated into a "brain," which is contained within a protective capsule, the "skull"; notochord not continued forward beyond the pituitary body; heart developed and divided into at least 2 parts, an auricle and a ventricle. (CRANIOTA.)

d. Respiration during part or the whole of life performed by means of gills; blood cold. (ICHTHYOPSIDA.)

e. Skull imperfectly developed and without jaws; paired fins undeveloped, with no shoulder girdle or pelvic elements; a single median nostril; gills purse-shaped; skin naked; skeleton cartilaginous. . . . . CYCLOSTOMI, B.

ee. Skull well developed and with jaws; shoulder girdle and pelvic elements developed; nostrils not median.

f. Limbs developed as rayed fins (rarely abortive); rayed fins normally present on the median line of the body; respiration throughout life by means of gills; lungs usually not developed.

g. Gills not free, being attached to the skin by the outer margin. Ova few and large, impregnated and sometimes developed internally; embryo with deciduous external gills; membrane bones of head undeveloped, except sometimes a rudimentary opercle; skeleton cartilaginous; skull without sutures; tail heterocercal; ventral fins abdominal; male with large intromittent organs or claspers attached to ventral fins; skin naked or covered with minute rough scales, sometimes with spines; no air bladder; arterial bulb with 3 series of valves; intestine with a spiral valve; optic nerves united by a chiasma; cerebral hemispheres united.

h. Gill openings slit-like, 5 to 7 in number; jaws distinct from the skull, joined to it by suspensory bones; no membrane bones; teeth distinct. (*Sharks* and *Skates.*) . . . . . ELASMOBRANCHII, C.

hh. Gill opening single, leading to 4 gill clefts; jaws coalescent with the skull; a rudimentary opercle; teeth coalescent, forming bony plates. (*Chimaeras.*) HOLOCEPHALI, D.

gg. Gills free, attached at base only to the gill arches; gill opening single on each side; eggs comparatively small and numerous; no claspers; membrane bones present on head; cerebral hemispheres not united. (*True Fishes.*) PISCES, E.

ff. Limbs not developed as rayed fins, but, if present, having the same skeletal elements as in the higher vertebrates; respiration in the adult chiefly accomplished by means of lungs, the gills usually not persistent; skin usually naked. AMPHIBIA, F.

dd. Respiration performed throughout life by means of lungs, the gill slits disappearing before birth.

i. Mammary glands not present; diaphragm incomplete; a single occipital condyle; oviparous (or sometimes ovoviviparous), the young hatched from a rather large egg. (SAUROPSIDA.)

j. Exoskeleton developed as scales or bony plates; blood cold; heart with 3 (rarely 4) cavities. . . . . REPTILIA, G.

jj. Exoskeleton developed as feathers; blood warm; heart with 4 cavities. AVES, H.

ii. Mammary glands present; the young developed within the body from a minute egg (except in the *Monotremata*), and nourished for a time after birth by milk secreted in the mammary glands; exoskeleton developed as hair; 2 occipital condyles; diaphragm complete; heart with 4 cavities; blood warm. . . . . MAMMALIA, I.

Of these classes, the *Tunicata* and the *Enteropneusta*, which have rarely found their way into Ichthyology, are excluded from the plan of the present work. The *Tunicata* are all marine forms, of small size, the larger species being familiarly known as "Sea Squirts," "Sea Peaches," and "Sea Pears"; but the most of them are without common names. A considerable number of species, representing several families, are found on our Atlantic coast. The *Enteropneusta* consist mainly of the single genus *Balanoglossus*, a worm-like creature, of which a few are found on our coasts. They reach a length of 6 to 12 inches. They have been considered as worms having possible affinities with the Echinoderms, but recent studies show conclusively that their place is with the *Chordata*.

Class A. LEPTOCARDII (The Lancelets)

Skeleton membrano-cartilaginous; no brain; no skull; the notochord persistent and extending to front of body; no heart, its place being taken by pulsating sinuses; blood colorless; respiratory cavity confluent with cavity of body; abdominal pore in front of vent; no jaws; the mouth inferior, slit-like, usually with cirri on each side. (Gr., λεπτός, thin; καρδία, heart.)

Order I. CIRROSTOMI

The single order of this class contains 2 or possibly 3 families and about 30 species, found buried in sand in warm regions, occasionally rising to the surface. From the *Branchiostomidae*, the *Epigonichthyidae* of the tropics differ in having gonads (reproductive structures) in the right side only. The *Amphioxididae* differ in lacking cirri about the mouth. These small organisms, however, may be merely larvae of other species. (Gr., κιρρός, cirrus; στόμα, mouth.)

a. Gonads on both sides alike; anal fin present, with traces of fin rays; no caudal process. Branchiostomidae, I.

Family I. BRANCHIOSTOMIDAE (The Lancelets)

Body elongate-lanceolate, compressed, naked, colorless, the fins represented by a low fold which extends along the back around the tail past the vent to the abdominal pore; eye rudimentary; liver a blind sac of the simple intestine; other characters as above. Small translucent creatures, sometimes existing in incredible numbers and (in China) serving as an article of food.

a. Snout not produced . . . . . Branchiostoma, 1.

1. BRANCHIOSTOMA Costa (*Amphioxus* Yarrell)

(Gr., βράγχια, gills; στόμα, mouth)

1. **B. virginiae** Hubbs. Virginia Lancelet. Amphioxus. Myocommata (muscular bands) about 38 + 15 + 12 = 65; tail short; vent near middle of lower caudal lobe. Sandy shores from Chesapeake Bay S. to N. C., burying in the sand; locally abundant. Near the European Lancelet (*B. lanceolatum* (Pallas)), and replaced S. of Cape Hatteras by other species of similar habit. (Low Lat., of Virginia.)

Class B. CYCLOSTOMI (The Myzonts)

Skeleton cartilaginous ; skull imperfect, not separate from vertebral column ; no jaws ; no limbs ; no ribs ; no shoulder girdle nor pelvic elements ; gills in the form of fixed sacs, 6 or more on each side ; nostril single, median ; mouth subinferior, nearly circular, adapted for sucking ; heart without arterial bulb ; alimentary canal straight, simple ; vertical fins with feeble rays. Naked, eel-shaped animals found in all cool waters. (Gr. *κύκλος*, circle; *στόμα*, mouth.)

Orders of Cyclostomi

a. Nostril tube-like with cartilaginous rings, penetrating the palate ; gill openings remote from the head ; no eyes. . . . . Hyperotreta, II.

aa. Nostril a blind sac not entering the palate ; gill openings close behind the head ; eyes well developed in the adult. . . . . Hyperoartia, III.

Order II. HYPEROTRETA

Characters as given above. Two families, the *Eptatretidae* having 6 to 14 gill openings and the *Myxinidae* a single gill opening on each side, leading by 6 ducts to 6 gill sacs. (Gr., *ὑπερῴα*, palate ; *τρητός*, perforate.)

Family II. MYXINIDAE (The Hagfishes)

Snout with eight barbels ; no lips ; a median tooth on the palate and 2 rows on each side of the tongue, which is a powerful organ with a strong fibrous tendon moving in a muscular sheath ; each side of abdomen with a series of mucous sacs ; no eyes ; intestine without spiral valve ; skin thin and loose ; eggs large, with a horny case and threads for adhesion. Lamprey-like animals, burrowing into the flesh of fishes, on which they feed ; marine.

2. MYXINE Linnaeus (Gr., *μύξα*, slime)

2. **M. glutinosa** Linnaeus. Hagfish. Borer. Bluish ; head 3½ to 4 in length. Newfoundland to Cape Cod, in rather deep water. Now considered identical with *M. glutinosa* of Europe. (Lat., glutinous.)

Order III. HYPEROARTIA (Gr., *ὑπερῴα*, palate ; *ἄρτια*, entire)

(Characters given above.)

Family III. PETROMYZONIDAE (The Lampreys)

Body eel-shaped, naked, compressed behind ; mouth subcircular, armed with horny teeth, which rest on papillae ; gill openings 7, arranged in a row along the side of the chest ; lips present, fringed ; nostril on top of head, just in front of eyes ; dorsal fin more or less notched ; intestine with a spiral valve ; eggs small. The lampreys undergo a metamorphosis, the larva of all species being toothless and having the eyes rudimentary. The name *Ammocoetus*

(later spelled *Ammocoetes*) was originally applied to a larval form known as "*Ammocoetes branchialis*," which is not yet referred to any particular species. Some of the larger species, marine and anadromous, mostly die after once spawning. Species few, of the fresh waters of temperate regions. They attach themselves to fishes, and feed by scraping off the flesh with their rasp-like teeth.

a. Buccal funnel (surrounding mouth), with series of teeth radiating in all directions from the mouth and deflected backward toward margin of disk.

b. Dorsal fins 2, more or less ~~widely~~ separated; innermost lateral disk teeth enlarged, 1 or more of them multicuspid; anterior lingual (tongue) lamina so sharply curved as to appear as 2 sharply denticulated ridges, without a differentiated median cusp; supraoral teeth close together; species of large size, marine, entering coastwise streams. PETROMYZON, 3.

bb. Dorsal fin single, merely notched; innermost lateral teeth mostly of 1 cusp; river lampreys.

c. Buccal funnel when fully expanded much broader than rest of body; supraoral lamina much contracted, its two ends usually close together. ICHTHYOMYZON, 4.

cc. Buccal funnel narrow, its width when expanded much less than that of body; supraoral lamina with 2 broad well-separated cusps; degenerate forms, with small weak teeth. . . . . REIGHARDINA, 5.

aa. Buccal funnel with its teeth not in radiating series, but in several groups; teeth largely multicuspid, inserted on edge of mouth; supraoral plate broad, the main cusps joined by a bridge; dorsal notched; fresh-water species, the upper intestine becoming obsolete in the adult.

d. Posterior series of small teeth developed, parallel to marginal series, and connecting the last pair of enlarged laterals; dorsal fins separated by a notch at base; all teeth blunt and weak. . . . . LETHENTERON, 6.

dd. Posterior series of small teeth wanting, none but the marginals present; 3 enlarged laterals. Cusps of supraoral usually with 2 tubercles, weak and rounded, the halves connected by a short isthmus; infraoral lamina low, without denticles, the crest often entire. . . . . OKKELBERGIA, 7.

3. **PETROMYZON** Linnaeus (Gr., *πέτρα*, a stone; *μύζω*, to suck)

3. **P. marinus** Linnaeus. GREAT SEA LAMPREY. "LAMPER EEL." Supraoral lamina bicuspid; infraoral cusps 7 to 9; first row of lateral teeth on side of mouth bicuspid; the others simple; myocommata 70 between gills and vent; males in spring usually with an elevated fleshy ridge before the dorsal. Color dark brown, usually mottled with blackish. L. 3 feet. N. Atl., S. to Fla., ascending rivers to spawn, and permanently landlocked in the lakes of W. and N. N. Y. (*P. dorsatus* Wilder). The larva is blind, toothless, with a contracted mouth, in which the lower lip forms a lobe distinct from the upper. The eyes appear before the mouth is enlarged. (*Eu.*) (Lat., marine.)

In the spring Lampreys ascend small brooks or the purpose of depositing their spawn. They are then often found clinging to stones and clods of earth. Later in the season they disappear, and are seldom seen except when attached to some unlucky fish. They are rarely seen descending the stream, and "it is thought by fishermen that they never return, but waste away and die, clinging to rocks and stumps of trees for an indefinite period; a tragic feature in the scenery of the river bottoms worthy to be remembered with Shakespeare's description of the sea floor." (*Thoreau.*)

4. ICHTHYOMYZON Girard (Gr., *ἰχσύς*, fish; *μύζω*, suck, sucker)

4. **I. concolor** (Kirtland). Supraoral lamina bicuspid; teeth on disk all simple, and placed in about 4 concentric series; infraoral lamina with 7 cusps; head 7½ in length; with gills 4¾; 51 muscular impressions between gills and vent. Buccal cirri in 2 rows. Color bluish silvery, sometimes mottled; a small bluish spot above each gill opening — this found even in the larva. L. 12. L. Erie to La. and N. to Hudson Bay. A common parasite on the sturgeon and other large fishes. (Lat., uniformly colored.)

5. REIGHARDINA Creaser & Hubbs

(For Dr. Jacob Reighard, Professor of Zoölogy in the University of Michigan)

5. **R. unicolor** (De Kay). Smaller and feebler, with weak teeth; buccal cirri matted; buccal funnel narrow; supraoral lamina with 2 small, well-separated cusps; intestine degenerate, not functional in adults; dorsals connected. Great Lakes and their tributaries. (Lat., one color.)

6. LETHENTERON Creaser & Hubbs

(Gr., *λέθος*, forgetting; *ἔντερον*, entrails)

6. **L. appendix** (De Kay). Brook Lamprey. Dorsals separated by a notch, both parts high; always 3 bicuspid teeth on each side of buccal disk; the other teeth simple; infraoral plate with 8 to 11 blunt subequal cusps; teeth all blunt and weak; buccal fimbriae palmate; intestines in adult degenerate, non-functional; head with gills 4¾ in body; myocommata 67, between gills and vent; an anal papilla present in males. Color bluish black. L. 8. E. N. Am.; ascending brooks in spring. Very abundant in Cayuga L. and in streams of Mich. and Wisc. (*Lampetra wilderi* Gage.) (Lat., *appendix*, from the anal papilla.)

7. OKKELBERGIA Creaser & Hubbs

(Named for Peter Okkelberg of the University of Michigan)

7. **O. lamottenii** (Le Sueur). Cusps of supraoral usually bitubercular, weak and rounded, connected by a short isthmus; infraoral lamina without denticles; crest often entire. Teeth generally few and feeble; myotomes few, 50 to 60 between last gill opening and vent; dorsal fin partly united. Ohio and Potomac River basins; not common. A degenerate form, lowest of lampreys. (*Ammocoetes aepyptera* Abbott.) (A personal name.)

Class C. ELASMOBRANCHII (The Selachians or Plagiostomes)

This group, sufficiently defined above, includes the sharks and the rays, — marine fishes of large size, abundant in most seas. (Gr., ἐλάσμός, blade ; βράγχος, gill.)

Orders of Elasmobranchii

a. Gill openings lateral.
b. Anal fin present; vertebrae with the hard (calcareous) material radiating from a center (asterospondylous), not arranged in rings. . . . . Euselachii, IV.
bb. Anal fin wanting; vertebrae degenerate, its harder material arranged in concentric rings. Cyclospondyli, V.
aa. Gill openings ventral; hard parts of vertebrae in concentric rings; no anal fin. Batoidei, VI.

Order IV. EUSELACHII (The Sharks)

The typical sharks are elongate in form, quite unlike the skates in appearance, the body being much longer than broad or deep. Intermediate forms constituting one order (*Cyclospondyli*) connect the two groups so closely that the position of the gill openings is the only constant character by which the sharks and rays can be separated. (Gr., ἔυ, well, for typical; σέλαχη, shark.)

Omitting extra-limital groups and deep-sea forms, we have the following analysis of the

Families of Euselachii

a. First D. long and low, highest posteriorly, extending to ventrals. . Pseudotriakidae, IV.
aa. First D. over or behind ventrals; nostrils confluent with the mouth; cirri developed about mouth. . . . . Orectolobidae, V.
aaa. First D. high, highest in front, not extending to ventrals.
b. Caudal not lunate, the upper lobe much longer than the lower (which may be wanting), with a notch below, toward its tip.
c. Last gill opening above base of pectoral.
d. Tail moderate, not half length of rest of body, provided with a lower lobe.
e. Head long, more or less pointed, not hammer-shaped. . . . Carcharhidae, VI.
ee. Head hammer-shaped or kidney-shaped, much broader than long. Sphyrnidae, VII.
dd. Tail very long, as long as rest of body, which is slender. . . . Alopiidae, VIII.
cc. Last gill opening before base of pectoral; dorsal fins subequal; spiracle obsolete; teeth very sharp. . . . . Odontaspidae, IX.
bb. Caudal fin lunate, the lower lobe not much shorter than upper; tail with a strong keel on each side; last gill opening before pectorals; spiracles obsolete.
f. Gill openings moderate; teeth large. . . . . Lamnidae, X.
ff. Gill openings excessively wide, nearly meeting above and below; teeth very small, in many series; largest of all fishes. . . . . Cetorhinidae, XI.

Family IV. PSEUDOTRIAKIDAE

8. PSEUDOTRIAKIS Capello

(Gr., ψεῦδος, false; *Triakis*, a genus allied to *Mustelus*)

8. **P. microdon** Capello. Grayish brown, the first D. edged with dusky. Base of first D. 7 times its height. L. 10 ft. Both sides of N. Atlantic ; very rare. (*Eu.*) (Gr., μικρός, small ; ὀδούς, tooth.)

Family V. ORECTOLOBIDAE (Nurse Sharks)

9. GINGLYMOSTOMA Müller & Henle

(Gr., *γίγγλυμος*, hinge ; *στόμα*, mouth.)

9. **G. cirratum** (Gmelin). Nurse Shark. Head obtuse, depressed ; nasal cirrus reaching lower lip ; angles of fins obtusely rounded ; skin very thick. Adults uniform brownish, the young with scattered black spots. L. 6 to 10 ft. Tropical America, rare N. to R. I. (Lat., bearing cirri.)

Family VI. CARCHARIIDAE (The True Sharks)

(Also called *Galeidae*, *Eulamiidae*, and *Carchariidae*)

Sharks with 2 dorsals and an anal fin ; no spines ; tail moderate, not lunate, bent upward, the fin notched below, near the tip ; basal lobe short ; no caudal keel ; last gill opening above base of pectoral ; head normally formed, never hammer-shaped ; eye with nictitating membrane ; species abundant in all warm seas.

a. Teeth blunt, paved, without cusps or cutting edges; no pit at root of tail; mouth with labial folds. (*Mustelinae.*)
b. Embryo without placenta; teeth all very blunt. . . . . Cynias, 10.
aa. Teeth more or less compressed, with sharp cutting edges. (*Carcharhininae.*)
c. Spiracles present; teeth large, serrated; root of tail with a pit above; caudal fin with 2 notches. . . . . Galeocerdo, 11.
cc. Spiracles none; teeth sharp; a pit at root of tail.
d. Teeth in the adult all more or less serrate.
e. First dorsal inserted far behind ventrals. . . . . Prionace, 12.
ee. First dorsal inserted close behind ventrals. . . . . Carcharias, 13.
dd. Teeth all entire.
f. Teeth all erect or very nearly so. . . . . Aprionodon, 14.
ff. Teeth all (except median ones) oblique, their points so turned aside as to form a nearly horizontal cutting edge. . . . . Scoliodon, 15.

10. CYNIAS Gill (Gr., *κύνος*, dog)

10. **C. canis** (Mitchill). Spotted Hound. Dog Shark. Switch-Tail. Boca Dulce. First dorsal higher than long, its middle equidistant between pectorals and ventrals ; snout short. Pale gray, more or less marked with whitish spots. L. 24. Smallest of our sharks. N. Atl.; common on both shores N. (*Eu.*) (Lat., *canis*, dog.)

11. GALEOCERDO Müller & Henle

(Gr., *γᾶλεός*, shark ; *κερδώ*, fox)

11. **G. tigrinus** Müller & Henle. Tiger Shark. Brown, with numerous large dark spots. L. 10 feet. Warm seas ; rarely N. to Mass.

12. PRIONACE Cantor (Gr., *πρίων*, saw ; *ἀκμή*, point)

12. **P. glauca** (Linnaeus). Great Blue Shark. Color grayish blue ; snout very long. A large swift shark of the warm seas, fairly common on our coasts northward. Known by the backward insertion of the dorsal.

13. CARCHARIAS Rafinesque

(*Carcharias* Müller & Henle, and Cuvier; in part also of Rafinesque; *Carcharhinus* Blainville; *Eulamia* Gill)

(Gray Sharks, Requins) (Gr., καρχαρός, jagged; ῥίνη, shark)

(The largest genus of sharks, found in most warm seas; all have sharp teeth, some of them with incurved tips, all of them more or less serrate on the edge. The application of the name *Carcharias* to this genus is open to serious question. Until a final decision is made, I follow the custom which is apparently correct. The alternative names are *Carcharhinus* and *Eulamia*.)

a. Upper teeth oblique, more or less notched on the outer margin; lower teeth narrower, erect.

13. C. **obscurus** (Le Sueur). Head pointed; second dorsal smaller than anal; pectorals large, twice as long as broad; first dorsal large. L. 10 feet. N. Atl. Frequent on our coast. (Lat., obscure.)

14. C. **milberti** (Müller & Henle). Head less pointed; second dorsal about as large as anal; pectoral fin somewhat longer than broad. Atl.; not rare on our coast. (Named for Milbert, an early French collector in New York.)

15. C. **acronotus** (Poey). Sharp-back Shark. Nasal flap with an acute lobe. Snout not very short, its length not notably less than width of mouth. Yellowish or greenish brown. Cuba, rare N. to N. C. (Gr., ἀκρός, sharp; νῶτος, back.)

16. C. **carcharias** (Linnaeus). Cub Shark. Lamia. Snout very short, its length from mouth less than width of mouth; pectoral rather broad, long and falcate, reaching posterior part of base of D. L. 10 ft. or more. Occasional on our S. Atlantic coast. (Eu.) (*C. lamia* Rafinesque; *C. commersoni* Blainville.) (Gr., καρχαρός, jagged.)

aa. Upper teeth narrow, erect, not strongly serrated. (*Isogomphodon* Gill.)

17. C. **limbatus** (Müller & Henle). Gray, tips of fins black. Tropical Atl., N. occasionally to Woods Hole and L. I. (Lat., edged.)

14. APRIONODON Gill

(Gr., ἀπριών, without saw; ὀδών, tooth)

18. A. **isodon** (Müller & Henle). Pectorals long, reaching base of first dorsal; teeth $\frac{31}{31}$, slender, erect, the lower smaller. W. Atl., N. to N. Y. (Gr., ἴσος, equal; ὀδών, tooth.)

15. SCOLIODON Müller & Henle

(Gr., σκολιός, oblique; ὀδών, tooth)

19. S. **terrae-novae** (Richardson). Sharp-nosed Shark. Body slender; snout depressed; mouth with short labial grooves on both jaws; second dorsal

smaller than anal. Gray ; tail dusky-edged. W. I., N. to Cape Cod, common S. (erroneously ascribed to Newfoundland).

Family VII. SPHYRNIDAE (The Hammer-headed Shark)

Characters of the *Carchariidae*, except that the head is curiously formed, being hammer-shaped or kidney-shaped, the sides being much extended, the eyes borne on the ends of the hammer. Teeth oblique, with a notch on the outside ; no spiracles. Five species, of the warm seas.

a. Head truly hammer-shaped ; a long groove extending forward from nostrils. Sphyrna, 16.
aa. Head kidney-shaped ; frontal grooves obsolete. . . . . Reniceps, 17.

16. SPHYRNA Rafinesque (Gr., *σφῦρα*, hammer)

20. **S. zygaena** (Linnaeus). Hammer-headed Shark. Width of "hammer" twice its length. Gray. L. 15 to 20 feet. All warm seas, N. to N. Mass. (*Eu.*) (Gr., *ζυγαίνα*, an old name, from *ζυγόν*, yoke.)

17. RENICEPS Gill (Lat., *rena*, kidney ; *ceps*, head)

21. **R. tiburo** (Linnaeus). Bonnet-head Shark. Width of "hammer" not nearly twice its length. Ashy gray. L. 3 to 5 feet. Warm seas, N. to N. J. (*Eu.*) (Spanish name of a shark.)

Family VIII. ALOPIIDAE

Body rather slender ; snout short ; teeth equal, flat, triangular, entire ; gill openings moderate, the last above P. ; no nictitating membrane ; spiracles obsolete ; first dorsal large ; second dorsal and anal very small ; tail about as long as rest of body ; no caudal keel ; pectorals falcate, very large. One species, a long and slender shark, found in most warm seas.

18. ALOPIAS Rafinesque (*Vulpecula* (Valmont) Garman)

(Gr., *ἀλωπός*, foxy)

22. **A. vulpinus** (Bonnaterre). Thresher. Swingle-tail. Fox Shark. Color gray. L. about 20 feet. Open sea ; occasionally on our coast. (*Eu.*) (Lat., foxy.)

Family IX. ODONTASPIDAE (The Sand Sharks)

(*Carchariidae* of authors)

Body elongate, the snout sharp ; mouth wide, the teeth large, long, narrow, entire, very sharp, most of the teeth with 1 or 2 small cusps at base ; gill openings all in front of pectorals ; dorsal small, similar to the anal ; tail as in *Carchariidae*, with which group it has little else in common ; no nictitating membrane ; spiracles minute. Few species now living ; many fossil forms. Savage sharks.

19. ODONTASPIS [1] Agassiz (*Carcharias* Rafinesque, in part)

(Gr., ὀδών, tooth; ἀσπίς, shield.)

23. **O. littoralis** (Mitchill). Sand Shark. Shovel-nose. Ground Shark. Blue Dog. Pectoral short. Color gray. L. 9 feet. Bay of Fundy to S. C., rather common N. The American form (*littoralis*) is regarded by Garman as not distinct from the European, *O. taurus* Rafinesque. A fierce and greedy shark. (Lat., of the shore.)

Family X. LAMNIDAE (Mackerel Sharks)

Body robust, contracted to a rather slender tail, which has a keel on each side; caudal fin lunate, the lower lobe nearly as large as the upper and not very different in form; teeth large; gill openings wide, all in front of pectorals; first dorsal and pectorals large; second dorsal and anal very small; a pit at root of caudal; spiracles obsolete. Large, voracious sharks of the warm seas. Many fossil forms known.

a. Teeth slender, sharp, with entire edges; tail very slender.
b. Teeth very slender, flexuous, without basal cusps. . . . . Isurus, 20.
bb. Teeth broader, most of them with a small cusp on each side at base. . . Lamna, 21.
aa. Teeth broad, compressed, triangular, distinctly serrate, without basal cusps; tail stout. Carcharodon, 22.

20. ISURUS Rafinesque (Gr., ἴσος, equal; οὐρά, tail)

24. **I. tigris** (Atwood). Tiger Mackerel Shark. Bluish gray, white below, the outline sharply defined on the tail. L. 15 feet. W. I., frequently N. to Mass. Bay. A swift and fierce shark, related to abundant fossil species. (Lat., tiger.)

21. LAMNA Cuvier (Porbeagle)

(Gr., λάμνα or λαμία, a sea monster, the name used to scare children)

25. **L. nasus** Bonnaterre. Mackerel Shark. First dorsal close behind pectorals; most of the teeth with a sharp denticle at base, much as in *Odontaspis;* snout conical, sharp. L. 10 feet. Warm seas, N. to Bay of Fundy and Cornwall. (*Eu.*) (*L. cornubica* Gmelin.) (Lat., *nasus*, long-nosed.)

22. CARCHARODON (Andrew Smith) Müller & Henle

(Great White Sharks) (Gr., καρψαρός, jagged; ὀδών, tooth)

26. **C. rondeleti** Müller & Henle. Man-eater Shark. Great White Shark. Teeth large, serrate, triangular in form, the tip bluntish. First

[1] The name *Squalus carcharias* of Linnaeus was based on an account by Artedi. This, in turn, was based on various authors, most of them having in mind the species here called *Carcharias carcharias*, later by Rafinesque, Risso, Cuvier, and others termed *Carcharias lamia*. As Rafinesque's first paper included new species and genera only, the known species appearing a month later, and as his only "new" species under *Carcharias* was an Odontaspis, the name *Carcharias*, based actually on *Squalus carcharias* Linnaeus, has been held to replace *Odontaspis*. In view of the resultant confusion, the International Commission of International Nomenclature has been asked to treat Rafinesque's "Caratteri" and "Indice" as parts of the same paper.

dorsal somewhat behind pectorals. Color leaden-gray ; P. edged with black. L. 35 feet. A savage brute, the most voracious of all sharks and next in size to *Cetorhinus*, weighing nearly a ton. Warm seas, occasional off our coasts. A stray individual, in recent years, worked havoc among the bathing resorts on New Jersey coast. Linnaeus says, "Jonam prophetam ut veteres Herculem, in hujus trinoctem ventriculo tridui spateo, baesisse verosimile est." The fossil teeth of a vastly larger extinct species, 150 feet long in life, *Carcharodon megalodon*, are often found in Tertiary beds along our S. Atl. coast ; three other species equally large are found fossil in Cal. (Named for Guillaume Rondelet, an early and careful naturalist.)

Family XI. CETORHINIDAE (The Basking Sharks)

Largest of all fishes ; immense sharks with the gill openings extremely wide, nearly meeting above and below ; mouth moderate ; teeth very small, numerous, conical, simple ; no nictitating membrane ; spiracles very small ; gill arches with conspicuous gill rakers ; 1st dorsal and pectorals large; 2d D. and anal small ; caudal lunate, the upper lobe the larger ; tail keeled on the side. One species, a huge, sluggish creature, of northern seas.

23. CETORHINUS Blainville (Gr., κῆτος, whale; ῥίνη, a shark, from ῥῖνη, a rasp, alluding to the rough skin)

27. **C. maximus** (Gunner). Basking Shark. Bone Shark.[1] Head small ; snout blunt. Gray. L. 35 feet ; depth nearly 6 feet. Northern seas S. to Va. and Cal. (*Eu.*) (Lat., largest.)

Order V. CYCLOSPONDYLI

Sharks without anal fin ; the vertebrae degenerate or cyclospondylous, the harder parts in one or more concentric rings not radiating from the center.

a. Squaloidei. Pectoral fin moderate, without deep notch in front; hard parts of each vertebra forming a single ring about the central axis.
b. Dorsal fins each with a strong spine. . . . . Squalidae, XII.
bb. Dorsal fins each without spine.
e. Skin with minute tubercles. . . . . Somniosidae, XIII.
ee. Skin with coarse tubercles. . . . . Echinorhinidae, XIV.
aa. Squatinoidei. Pectoral fins very large, wing-like, expanded at base in front, this extension separated from the neck by a deep notch; hard parts of each vertebra tectospondylous, that is arranged in several concentric rings about a central axis.
Squatinidae, XV.

Family XII. SQUALIDAE (The Dogfishes)

Sharks with 2 dorsal fins, one or both armed with a stout spine, and without anal fin ; no nictitating membrane ; spiracles moderate ; gill openings narrow, all before pectorals ; ventral fins inserted posteriorly ; teeth small, com-

[1] This name is given because of the gill rakers, which suggest whalebone.

pressed; nostrils inferior, near front of snout. Small sharks, found in most seas; the species not numerous.

a. Teeth alike in both jaws, subquadrate, each with a nearly horizontal cutting edge and a point directed outward; dorsal spines strong, in all near-shore species. . SQUALUS, 24.
aa. Teeth unequal, the upper very small, lanceolate, erect, the lower oblique; dorsal spines hidden in the skin. . . . . CENTROSCYMNUS, 25.

24. SQUALUS (Artedi) Linnaeus (Lat., shark)

28. **S. acanthias** Linnaeus. DOGFISH. PIKED DOG. GRAYFISH. Dorsal spines not grooved. Slate-color; back with whitish spots, fading with age. L. 3 feet. N. Atl., S. to Cuba; abundant N. Its liver valued for the "dogfish oil." (*Eu.*) (Gr., *ἀκανθίας*, having spines, an old name of the dogfish.)

25. CENTROSCYMNUS Bocage & Capello

(Gr., *κέντρον*, spine; *scymnus*, a kind of shark)

29. **C. coelolepis** Bocage & Capello. Deep Atl.; occasional off Cape Ann and the banks N. (*Eu.*) (Gr., *καιλός*, hollow; *λεπίς*, scale.)

FAMILY XIII. SOMNIOSIDAE (THE SLEEPER SHARKS)

Sharks with 2 small dorsal fins, about equal, both without spines; no anal fin; the first dorsal much before ventrals; tubercles or scales few and small; upper teeth lancet-shaped, incurved; lower quadrate, with a horizontal edge, ending in a point directed outward; otherwise essentially as in the *Squalidae*. Large, clumsy, sluggish sharks of the northern seas, excessively greedy.

26. SOMNIOSUS Le Sueur (Lat., sleepy)

30. **S. microcephalus** (Bloch). SLEEPER. NURSE SHARK. GURRY SHARK. First dorsal anterior. Color blackish. L. 10 to 18 feet. Arctic seas, S. to Cape Cod. (*Eu.*) (Gr., *μικρός*, small; *κεφαλή*, head.)

30*a*. **S. brevipinna** Le Sueur. First dorsal median. Arctic seas, S. to Cape Cod, and Los Angeles. (Lat., short fin.)

FAMILY XIV. ECHINORHINIDAE (THE BRAMBLE SHARKS)

Large sharks with small fins, the skin covered with rough thorns like those on a bramble, and like them leaving a scar when broken off. Teeth small, very oblique. One species known.

27. ECHINORHINUS Blainville (Gr., *ἐχῖνος*, hedgehog; *ῥίνη*, shark)

31. **E. brucus** (Broussonet). Atl.; occasional off Cape Cod. (*Eu.*) (Gr., *βροῦκος*, a wingless locust; the application not evident.)

FAMILY XV. SQUATINIDAE (THE ANGEL FISHES)

Ray-like sharks, with the body depressed, the pectoral fins very large, expanded in the plane of the body, the anterior margin bearing some resemblance

to the bend of the wing in birds ; ventrals very large ; 2 dorsal fins, small, subequal, behind ventrals ; caudal small ; no anal ; gill openings wide, subinferior, partly hidden by base of pectoral; spiracles wide, crescent-shaped, behind eyes ; mouth and nostrils anterior ; teeth small, conical, pointed, distant. Several species, in most seas. The singularly formed pectoral fins give an absurd resemblance to the conventional pictures of angels.

28. SQUATINA Duméril (The ancient name)

32. **S. dumeril** (Le Sueur). Angel Fish. Monk Fish. Skin rough, with small, stiff prickles. Ashy gray above, usually much mottled. L. 3 or 4 feet. Western Atl. ; occasional N. A near ally of the European *S. squatina* (L.), which has also been recorded on our coasts. (Named for Constant Duméril.)

Order VI. BATOIDEI (The Rays)

The Rays, as a whole, differ from the Sharks in having the gill openings underneath the flat disk formed by the body and the expanded pectoral fins. The tail is comparatively slender and its fins are small. Spiracles present. The *Rajidae* produce large eggs, enclosed in leathery cases ; most of the other *Raiae* are ovoviviparous, bringing forth their young alive. (Gr., *βάτος*, skate; *εἶδος*, like.)

Families of Batoidei

a. Tail comparatively thick, with 2 dorsal fins; no serrated caudal spine nor cephalic fins (*Sarcura.*)
  b. Snout much produced, flat, armed with strong teeth on each side, set at right angles to its axis; body somewhat shark-like, the disk gradually passing into the tail. Pristidae, XVI.
  bb. Snout not saw-like; disk ending abruptly at base of tail.
    c. Electric organs wanting; skin not perfectly smooth; ventral fins notched behind; caudal a narrow fold.
      d. Pectorals not extended on to snout; disk gradually passing into tail; viviparous. Rhinobatidae, XVII.
      dd. Pectorals extended on to snout; disk abruptly wider than the tail; ovoviviparous. Rajidae, XVIII.
    cc. Electric organs present—a structure of honeycomb-like tubes between pectoral fins and head; skin perfectly smooth; ventral fins notched behind; caudal fin well developed. . . . . Torpedinidae, XIX.
aa. Tail slender, with but 1 dorsal fin or none, usually armed with a serrated spine. (*Masticura.*)
  e. Pectoral fins uninterrupted, confluent about the snout; teeth small. Dasyatidae, XX.
  ee. Pectoral fins divided, leaving detached appendages ("cephalic fins") on the snout.
    f. Teeth very large, flat, in mosaic in one or more rows. . . . . Myliobatidae, XXI.
    ff. Teeth rather small, subequal in several rows. . . . . Rhinopteridae, XXII.
    fff. Teeth very small, flat or tubercular, often wanting in one jaw. Size enormous; among the largest of fishes. . . . . Mobulidae, XXIII.

Family XVI. PRISTIDAE (The Sawfishes)

Rays with elongate body, stout, thick tail, and a long, saw-like snout, below which is the inferior mouth with small, blunt teeth. Dorsals and caudal well developed. One genus, with 5 or 6 species ; in warm seas.

29. PRISTIS Linck

(Gr., πρίστης, one who saws; the ancient name)

33. **P. pectinatus** Latham. Sawfish. Saw with 25 to 28 pairs of spines. L. 10 feet. W. I.; occasional N.; entering streams. (Lat., comb-toothed.)

Family XVII. RHINOBATIDAE (Guitar Fishes)

Shark-like rays with long disk gradually passing into the thick tail; 2 well-developed dorsals; young born free of an egg case.

30. RHINOBATOS[1] Linck (Gr., ῥῑνός, nose; βάτος, skate)

34. **R. lentiginosus** (Garman). Clear-Nose. Guitar Fish. Disk subtriangular, ⅓ total length; tail ½ length; snout slender, pointed, teeth small obtuse. Brown above, with numerous small light spots. N. C., south. (Lat., freckled.)

Family XVIII. RAJIDAE (The Skates)

Rays with the disk broad, rhombic, more or less rough; the males usually with about 2 rows of strong spines on each pectoral; tail rather stout, with a fold of skin on each side and 2 dorsal fins above; caudal fin small or obsolete; no serrated spine; no electric organs. Egg in a large leathery case, 4-angled, and having 2 tubular horns at each end. Species numerous; mostly of the northern seas.

a. Caudal fin rudimentary; pectorals not confluent, leaving a translucent area at the snout; ventrals deeply notched. . . . . Raja, 31.

31. RAJA (Artedi) Linnaeus (*Raia* or *Raja*, the Latin name)

a. Middle line of back and tail behind shoulders unarmed in adult, with a row of spines in young; outline of disk before spiracles obtuse, without acute angle at tip of snout.

b. Rows of teeth about $\frac{50}{50}$.

35. **R. erinacea** Mitchill. Common Skate. Little Skate. Bonnet Skate. Tobacco Box. Spines largest on front of pectorals; smaller ones on head, back, and shoulder girdle. Light brown, with round dark spots. L. 2 feet. Smallest and commonest of our skates, from Va. northward. (Lat., hedgehog.)

bb. Rows of teeth about $\frac{80}{80}$.

36. **R. senta** Garman. Much like *R. erinacea;* the snout sharper, besides other differences. Coast of Mass.; rare. (Lat., thorny.)

37. **R. diaphanes** Mitchill. Winter Skate. Spotted Skate. Similar to *R. erinacea*, but much larger, and with additional rows of spines along the back and on sides of tail. Light brown, with dark spots; usually a large white ocellus with a dark center on P. behind. L. 3 feet. N. J., N. (Gr., διάφανης, translucent.)

[1] *Rhinobatus* of Schneider and most authors.

aa. Middle line of back and tail with a row of spines at all ages; outline of disk before spiracles forming a more or less marked angle at tip of snout.

c. Angle at tip of snout short, obtuse; teeth $\frac{28}{28}$; body and tail with strong spines with broad stellate bases.

38. **R. scabrata** Garman. Prickly Skate. A median dorsal row of large spines or bucklers; others about head. L. 1½ to 2 feet. N. E. coast; rather rare, S. to Conn. Representing the European *R. radiata* Donovan. (Lat., roughened.)

cc. Angle at tip of snout acute, moderately long; teeth $\frac{88}{88}$; no coarse spines or bucklers.

39. **R. eglanteria** Lacépède. Brier Skate. Prickles small and sharp; a large spine on each shoulder. Brown, with darker bars and blotches. L. 3 feet. N. Mass., southward; not common. (*Eglantine*, brier rose.)

ccc. Angle at tip of snout much produced, blunt; teeth $\frac{36}{36}$.

40. **R. laevis** Mitchill. Barn-door Skate. Spines of body very few and small, on head and back; a row of larger ones on median line of tail; female rougher, as is usual among Rays; snout very long, somewhat spatulate. Color brownish, with paler spots, mostly ringed with darker. Largest of the rays of the Atlantic. L. 6 feet. Va., N.; not rare. (*R. laevis* Mitchill, name not preoccupied in accepted nomenclature.) (*R. stabuliforis* Garman.) (Lat., smooth.)

Family XIX. TORPEDINIDAE (The Electric Rays)

Trunk broad and smooth, the tail short and thick, with rayed caudal and usually 2 rayed dorsals, the first over or behind ventrals; a large electric organ made up of hexagonal tubes, between head and pectorals. Species found in most warm seas; noted for their power of giving electric shocks.

a. Spiracle placed nearly an eye's diameter behind eye. . . . . Tetronarce, 32.

aa. Spiracle opening very close behind eye. . . . . Narcine, 33.

32. TETRONARCE Gill

(Gr., *τέτρα*, 4-cornered; *νάρκη*, numbness, an old name of the Torpedo)

41. **T. occidentalis** (Storer). Torpedo. Crampfish. Numbfish. Black, with obscure darker blotches; spiracles with entire edges. L. 3 to 5 feet. Maine, S.; not common. Very near the European *T. nobiliana* (Bonaparte).

33. NARCINE Henle (Gr., *νάρκη*, numbness, old name of the Torpedo)

42. **N. brasiliensis** (von Ölfers). Numbfish. Disk oval or nearly circular; snout broadly rounded, not exserted; tail 1⅔ times the length of disk. Color variable, more or less blotched. N. C. to Brazil, rare on our coast.

Family XX. DASYATIDAE (The Sting Rays)

Disk broad, the pectorals confluent anteriorly, forming tip of snout; tail usually whip-like, sometimes short and stout, with or without fins, but never

with 2 dorsals. Tail usually armed with a sharp, retrorsely serrate spine above, near the base (this often duplicated and sometimes wanting); ventral fins entire. Skin smooth or variously rough, the adult roughest. Mouth small, with small teeth. Sexes similar. Species numerous, in all warm seas. The large spine or "sting" on the tail in most species may inflict a dangerous wound through blood-poisoning.

a. Tail slender, whip-like, without caudal fin, longer than the disk; "sting" on tail strong. DASYATIS, 34.

aa. Tail very slender and short, shorter than the very broad disk; sting minute or wanting. PTEROPLATEA, 35.

aaa. Tail stout, with a caudal fin; "sting" strong. . . . . UROBATIS, 36.

34. DASYATIS Rafinesque (*Trygon* Adanson)

(Gr., δᾱσύς, shaggy or rough; βατίς, skate)

a. Tail with a fold on its lower margin only, the upper edge rounded. (*Pastinachus* Rüppell.)

43. **D. centroura** (Mitchill). COMMON STING RAY. CLAMCRACKER. STINGAREE. Snout not prominent; disk a little wider than long; tail usually not quite twice length of disk. Adult with some stellate tubercles on back and tail. Color olive brown. Cape Cod, S.; common. (*Eu.*) (*D. marinus* (Klein) Garman.) (Gr., κέντρον, spine; οὐρά, tail.)

aa. Tail with a fold of skin on its upper as well as lower margin. (*Amphotistius* Garman.)

44. **D. hastata** (De Kay). STING RAY. Upper fold of tail only a keel; shoulder with 3 series of tubercles; tail less than twice length of disk. W. I., rare N. to Cape Cod. (Lat., armed with a spear.)

45. **D. say** (Le Sueur). SOUTHERN STING RAY. WHIPPAREE. Snout not prominent; disk a little wider than long; tail nearly twice length of disk. Body and tail without large spines. N. Y., S. to Brazil. (To Thomas Say, a distinguished zoölogist.)

35. PTEROPLATEA Müller & Henle

46. **P. micrura** (Schneider). BUTTERFLY RAY. Disk nearly twice as broad as long, more than 3 times as long as tail; sting on tail usually obsolete; no tentacle behind spiracle. Olive-brown, finely marbled and speckled; tail with 4 or 5 dark blotches; front edge of disk with pale half-circular spots. Mass., S. to W. I. (Gr., μικρός, small; οὐρά, tail.)

47. **P. altavela** (Linnaeus). BUTTERFLY RAY. Disk twice as broad as long, little more than twice tail; sting well developed; a tentacle behind eye. Brown, marbled or vermiculated with lighter; about 6 transverse blotches on tail behind spine. W. I., rare N. to L. I. (Lat., *altus*, high; *velum*, sail or cover.)

36. UROBATIS Garman (Gr., οὐρά, tail; βατίς, skate)

48. **U. sloani** (Blainville). ROUND STING RAY. Disk a little broader than long; tail about as long as disk. Skin rough, but without median

tubercles. Brown, spotted with yellow. Size small. W. I., rare N. to N. C. and N. J. (To Sir Hans Sloane, author of a history of Jamaica.)

Family XXI. MYLIOBATIDAE (The Eagle Rays)

Pectoral fins interrupted, reappearing on tip of snout as 1 or 2 detached appendages or cephalic fins ; skull somewhat elevated, so that eyes and spiracles are lateral ; teeth large, flat, hexangular, the middle series largest. Otherwise essentially as in *Dasyatidae*. Species in all warm seas.

a. Snout entire.
b. Teeth very broad, in one series. . . . . Aëtobatus, 37.
bb. Teeth in several series, the middle series broadened. . . . . Myliobatis, 38.

37. AËTOBATUS [1] Blainville (*Stoasodon* Cantor)

(Gr., *ἀετός*, eagle; *βάτος*, ray)

49. **A. narinari** (Euphrasen). Bishop Ray. Size very large. Disk twice as broad as long. Tail very long, 3 or 4 times disk. Brown, with many conspicuous round yellowish spots; teeth deep blue. Warm seas, N. to Va. (*Narinari*, a Brazilian name.)

38. MYLIOBATIS [1] Duméril (Eagle Rays)

(Gr., *μυλιός*, grinding ; *βάτις*, ray)

50. **M. freminvillii** (Le Sueur). American Eagle Ray. Skin smooth. Color plain reddish brown. W. I., rarely N. to Cape Cod. (For Christian Paulin de Freminville, a French naturalist.)

Family XXII. RHINOPTERIDAE (The Cow-nosed Rays)

Snout very broad, emarginate, appearing 4-lobed. Teeth relatively small, subequal, in many rows. Otherwise much as in *Myliobatidae*. Species few.

39. RHINOPTERA Kuhl (Cow-nosed Rays)

(Gr., *ῥίν*, snout; *πτερόν*, fin)

51. **R. bonasus** (Mitchill). Cow-nosed Ray. Cephalic fin emarginate, and placed below level of pectorals, so that the snout appears 4-lobed when viewed from the front. Skin nearly smooth. Cape Cod, S. " He enters the bay and ranges very extensively the flats where the soft clam lives. These shellfish he is supposed to devour, for a shoal of cow-noses root up the salt-water flats as completely as a drove of hogs would do." (*Mitchill.*) (*R. quadriloba* Le Sueur.) (Lat., a buffalo.)

[1] The name *Aëtobatus* (1816), as well as *Myliobatis* (1917), was based on the eagle rays, "raies aigles," of which the eagle ray (*Raja aquila* Linnaeus) of the Mediterranean is the type. But Blainville inadvertently recorded this species as "*Aëtobatus vulgaris*," a bare name without explanation. Müller and Henle (1838) used the later name, *Myliobatis*, for this genus, defining a new one, Aëtobatis, for the "bishop rays," later called *Stoasodon* by Cantor, an arrangement which should properly hold.

Family XXIII. MOBULIDAE (The Sea Devils)

Rays of immense size, similar to the Eagle Rays, but with the cephalic fins forming long, ear-like appendages, and with teeth very small. Skin rough. Species few. Among the largest of all fishes ; found in warm seas.

a. Teeth in lower jaw only; mouth terminal. . . . . Manta, 40.
aa. Teeth in both jaws; mouth inferior. . . . . Mobula, 41.

40. MANTA Bancroft

(*Manta*, blanket, " A name used at the pearl fisheries of Panama, for an enormous fish much dreaded by the divers, whom it is said to devour, after enveloping them in its vast wings.")

52. **M. birostris** (Walbaum). Sea Devil. Manta. Disk 12 feet long, its breadth about 20, not quite twice as broad as long ; tail as long as disk. Brown. Tropical seas, N. to Delaware Bay. (Lat., *bis*, two ; *rostrum*, snout.)

41. MOBULA Rafinesque

(*Mobular*, a vernacular name of the European species)

53. **M. hypostoma** (Bancroft). Small Devilfish. Tail much longer than body, without a serrated spine. Irregularly diamond shape. Cephalic lobes rolled from below outward. Skin smooth. N. C. to Brazil. (Gr., *ὑπο*, below ; *στόμα*, mouth.)

Class D. HOLOCEPHALI (The Chimaeras)

This class contains a single order, with six families, three of them entirely extinct.

Order VII. CHIMAEROIDEI

Skeleton cartilaginous; gill cavity with 4 clefts within, but with a single external opening which is covered by a fold of skin, with a rudimentary opercle. No spiracles. Notochord persistent, the vertebrae consisting of rings around the notochordal sheath. Jaws without separate teeth, but armed with flat, bony plates; no air bladder; intestine with a spiral valve; skin smooth, with a highly developed mucous system. Dorsal fin with a strong spine, the rays otherwise soft; fins leathery. Species mostly extinct, the living forms chiefly of the deep seas.

a. Snout short, not ending in a cutaneous flap. Claspers large, bifid or trifid, pectorals moderate. . . . . Chimaeridae, XXIV.

Family XXIV. CHIMAERIDAE (The Chimaeras)

(Gr., χιμαίδα, a fabulous monster, with a lion's head, a goat's body, and a serpent's tail)

Characters as stated above; males with a movable cartilaginous hook in the forehead, this turned forward and armed at tip with short strong spines. Oviparous, the eggs very large, their cases oblong, with silky filaments. Species mostly extinct, about 10 now living; all but one in deep waters of the Northern Hemisphere; some of them silvery, others jet black. Those of the longest-known genus, *Chimaera* Linnaeus, have a distinct anal fin.

a. Anal fin wanting; dorsal separate, the 2d not notched; claspers trifid.
Psychichthys, 42.

42. PSYCHICHTHYS Fowler

(Gr., ψύχη, soul (ghost); ἰχθύς, fish)

54. **P. affinis** (Capello). Color plumbeous. In deep or cold water, S. to Cape Cod and Portugal. (*Eu.*) (Lat., related; i.e., to *Chimaera monstrosa.*)

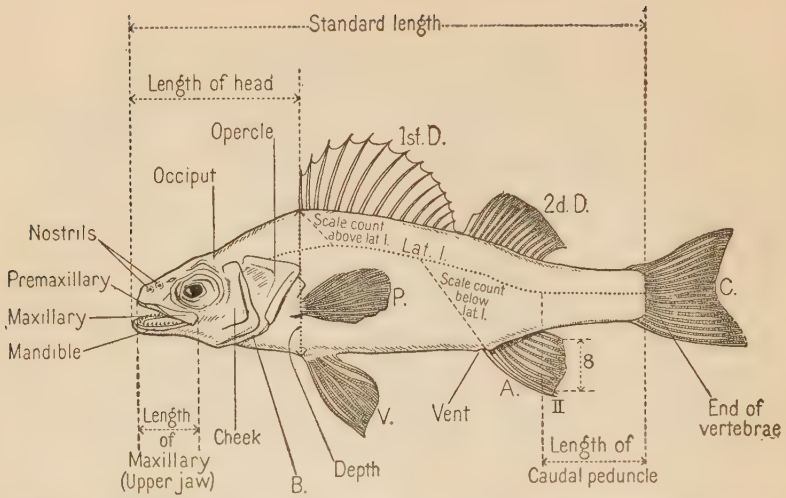

FIG. 1. Diagrammatic outline to show the application of the terms used in describing the external features of a Fish. Abbreviations: *A.*, anal fin; *B.*, branchiostegals; *C.*, caudal fin; *D.*, dorsal fin; *P.*, pectoral fin; *V.*, ventral fin; Lat. l., lateral line.

CLASS E. PISCES (THE FISHES)

A "Fish" in the popular sense is a member of any one of the classes of aquatic or fish-like vertebrates. But the Lancelets and the Lampreys differ so widely from the other groups that they must be excluded from consideration as fishes. The extinct classes of *Ostracophores* and *Arthrodires*, once confounded with the very different *Ganoidei*, are now excluded. The Fishes, as a whole, may then be defined as cold-blooded vertebrates adapted for life in the water, breathing by means of gills, which are not purse-shaped, but attached to bony or cartilaginous gill arches; having the skull well developed and with a lower jaw; with the limbs present and developed as fins, or rarely wanting through atrophy; with shoulder girdle present, furcula-shaped, curved forward and with the sides connected below; with pelvic bones present; having the exoskeleton developed as scales or bony plates or horny appendages, sometimes obsolete, and with the median line of body with one or more fins composed of cartilaginous rays connected by membrane.

Skeleton usually bony, sometimes cartilaginous. Skull with sutures; membrane bones (opercle, preopercle, etc.) present; gill openings a single slit on each side; gills with their outer edges free, their bases attached to bony arches, normally 4 pairs of these, the 5th pair being modified into tooth-bearing pharyngeals; upper jaw of bones distinct from palatine elements; median and paired fins developed, the latter with distinct rays. Ova small; no clasp-

ers. Heart developed, divided into an auricle, ventricle, and arterial bulb. Lungs imperfectly developed, or modified to form a swim bladder, or entirely absent.

We here include under one head the Ganoids and the Teleosts. The former type is chiefly composed of extinct forms. While many of its representatives are extremely dissimilar to the bony fishes, there is a gradual series of transitions, and between the *Halecomorphi* of the Ganoids and the *Isospondyli* of the true Teleosts, the resemblance is much greater than that between the *Halecomorphi* and many other Ganoids. The Ganoids are, in fact, the most generalized of the true fishes, those nearest the stock from which the Teleosts on the one hand, and the *Dipneusti* (*Dipnoi*) and *Amphibia* on the other, have sprung. Omitting orders not represented in our waters, we have the following analysis of

Orders of True Fishes

a. Arterial bulb muscular, with numerous valves; optic nerves forming a solid chiasma; ventrals abdominal; air bladder with a duct; tail strongly heterocercal throughout life; some fins usually with fulcra. (Ganoidei.)

b. Skeleton cartilaginous; ventrals with an entire series of basilar segments. (*Chondrostei.*)

c. Maxillary and interopercle obsolete; skin naked; air bladder cellular. Selachostomi, VIII.

cc. Maxillary and interopercle present; skin with bony shields; air bladder simple. Glaniostomi, IX.

bb. Skeleton bony; ventrals with basilar segments rudimentary; air bladder cellular. (*Holostei.*)

d. Vertebrae opisthocoelian (concavo-convex); maxillary transversely divided in several pieces; scales rhombic, enameled plates. . . . . Ginglymodi, X.

dd. Vertebrae amphicoelian (double concave); maxillary not transversely divided; scales cycloid. . . . . Halecomorphi, XI.

aa. Arterial bulb thin, with a pair of opposite valves; optic nerves crossing, not forming a solid chiasma; tail not stongly heterocercal. (Teleostei.)

e. Air bladder (if present) connected by an air duct with the intestinal canal, this persistent throughout life; ventral fins (if present) abdominal, without spines, their basilar segments rudimental. (Soft-rayed fishes.) (*Physostomi.*)

f. Premaxillary short, the maxillary forming the entire border of the upper jaw; scales mostly cycloid.

g. Anterior vertebrae similar to the others, not united or forming ossicles for hearing.

h. Shoulder girdle joined to the skull by means of a post temporal (suprascapula); scales mostly cycloid; form not eel-like.

i. Precoracoid present; head scaleless . . . . . Isospondyli, XII.

ii. Precoracoid obsolete; head scaly. . . . . Haplomi, XVIII.

hh. Shoulder girdle not joined to the skull; no precoracoid arch; maxillary wanting or united to the palatines; no ventral fins; scales minute or wanting; form eel-like.

j. Pectoral fins developed; gill openings rather wide slits. Enchelycephali, XIII.

jj. Pectoral fins absent; gill openings pore-like. . . . . Colocephali, XIV.

gg. Anterior 4 vertebrae much modified, united and with ossicles for hearing; precoracoid arch present. (*Ostariophysi.*)

k. Maxillary perfect, not forming the base of a long barbel; subopercle and symplectic present; supraoccipital and parietals coössified; body mostly scaly; head naked. . . . . Eventognathi, XV.

kk. Maxillary rudimentary, forming the base of a long barbel; no subopercle or symplectic; supraoccipital united to parietals; no scales. Nematognathi, XVI.

ff. Premaxillary long, forming the margin of the upper jaw, excluding the maxillaries from it. . . . . Iniomi, XVII.

ee. Air bladder without duct (in the adult); ventral fins with developed pelvic bone, usually,

but not always, anterior in position; spines usually present in the fins; pectoral fins not on the plane of the abdomen; parietal bones usually separated by the supraoccipital. (Spiny-rayed fishes chiefly.) (*Physoclisti.*)

ll. Adipose fin present; scales ctenoid; fin spines few. . . . . SALMOPERCAE, XX.

ll. Adipose fin wanting.

m. Vent at the throat (in the adult); fin spines few; scales ctenoid. XENARCHI, XXI.

mm. Vent normally placed (except in a few genera, which have either no spines at all, or many).

n. Lower pharyngeals coössified; no spines; ventrals abdominal; lateral line low, on side of abdomen. . . . . SYNENTOGNATHI, XXII.

nn. Lower pharyngeals separate (or if united, the dorsal fin with spines).

o. Pharyngeal bones and most of the branchihyals wanting; skin naked or with bony plates. . . . . THORACOSTEI, XXIII.

oo. Superior branchihyals and pharyngeals in normal development.

p. Pectoral fins not pediculate, the gill openings in advance of them.

q. Ventral fins without separate sucking disk between them.

r. Bones of the jaws not coössified.

s. Fins all composed of soft rays; no true spines in dorsal or ventrals.

t. Eyes normal.

u. Ventrals of about 15 rays; body very deep. SELENICHTHYES, XXV.

uu. Ventrals of fewer than 10 rays (except in some deep-sea species).

v. Dorsal fin very short, with few rays; gape arched. CYPRINODONTES, XIX.

vv. Dorsal fin extending along most of back, with many rays; gape nearly straight. . . . . ANACANTHINI, XXIV.

tt. Both eyes on the same side of the head, which is twisted to right or left. . . . . HETEROSOMATA, XXVI.

ss. Fins, especially the first dorsal, normally with spines; ventrals usually with the first ray spinous. (*Acanthopteri.*)

w. Ventrals, if present, thoracic or subabdominal, below or behind the pectorals.

x. Lower pharyngeals solidly united; gills $3\frac{1}{2}$, with no slit behind the last. . . . . PHARYNGOGNATHI, XXVIII.

xx. Lower pharyngeals separate, rarely united (in that case, the gills normally 4, with a slit behind the last).

y. Suborbital without bony stay.

z. Head without laminated sucking disk.

§ Gill membranes free from isthmus; pyloric caeca developed. . . . . ACANTHOPTERI, XXVII.

§§ Gill membranes united to isthmus; pyloric caeca obsolete. . . . . GOBIOIDEA, XXXI.

zz. Head with a laminated sucking disk, a modified first dorsal. . . . . DISCOCEPHALI, XXX.

yy. Suborbital with a bony stay, extending to or toward the preopercle, sometimes covering the cheek. CATAPHRACTI, XXIX.

ww. Ventrals, if present, jugular, the rays reduced in number.

§ Post-temporal simple. . . . . HAPLODOCI, XXXII.

§§ Post-temporal forked. . . . . DERIPIA, XXXIV.

rr. Bones of jaws more or less coössified, the maxillary with the premaxillary, the dentary with the articular; teeth separate or united; no spines. PLECTOGNATHI, XXXV.

qq. Ventral fins with a large sucking disk between them; no scales; no fin spines. . . . . XENOPTERYGII, XXXIII.

pp. Pectoral fins pediculate, the basal bones reduced in number and elongate, the gills in their axils. . . . . PEDICULATI, XXXVI.

More than 500 families are now recognized among the true fishes. The characters on which family divisions are based are usually internal, and

often difficult for the beginner to ascertain. The boundaries and definitions of many families are also uncertain. Therefore, instead of attempting a natural analysis under each order of the families included, it seems best to give instead an Artificial Key, by which the student can recognize any of the families of the true fishes included in this work. For analytical keys showing, in some degree, the natural characters, the student is referred to Jordan and Evermann's *Fishes of North and Middle America.*

Artificial Key to the Families of True Fishes Included in the Present Work

SERIES I. VENTRAL FINS PRESENT, ABDOMINAL

A. Dorsal fins 2, the anterior rayed, the posterior adipose.
B. Body naked; mouth with 4 to 8 long barbels; dorsal and pectoral each with a strong spine; adipose fin short; anal free from caudal.
C. Nostrils separated, the posterior with a barbel; barbels 8; no teeth on vomer or palatines. (Fresh-water Catfish.) . . . . . AMEIURIDAE, LI.
CC. Nostrils close together, neither with a barbel; palate with teeth. (Sea Catfish.) ARIIDAE, LII.
BB. Body scaly; no barbels; no spines.
D. Maxillary wanting, or grown fast to premaxillary; head scaly.
§ Luminous spots present. . . . . MYCTOPHIDAE, LIII.
§§ Luminous spots none. . . . . SYNODONTIDAE, LIV.
DD. Maxillaries distinct; head naked.
E. Scales ctenoid; margin of upper jaw formed by premaxillaries alone; spines few. PERCOPSIDAE, LX.
EE. Scales cycloid; margin of upper jaw formed in part by maxillaries; spines none.
F. Stomach a blind sac, with few pyloric caeca. (Smelt, etc.)
§ Mouth large and teeth strong; scales not spiny. . . . . OSMERIDAE, XL.
§§ Mouth small and nearly toothless; scales with spinous edges. ARGENTINIDAE, XLI.
FF. Stomach siphonal, with many pyloric caeca.
G. Mouth small, with weak teeth or none.
H. Dorsal fin moderate, of 10 to 12 rays. . . . COREGONIDAE, XXXVII.
HH. Dorsal fin large, of 20 to 25 rays. . . . . THYMALLIDAE, XXXIX.
GG. Mouth large, with strong teeth. . . . . SALMONIDAE, XXXVIII.
AA. Dorsal fin single, with free spines before it; body naked, or with bony plates; ventral rays, I, 1 or I, 2. . . . . GASTEROSTEIDAE, LXVII.
AAA. Dorsal fins 2, the anterior of simple rays or spines, the posterior chiefly of soft rays; ventrals, I, 5.
§ Pectoral fin with all rays joined together.
I. Teeth very strong, unequal; a lateral line present. . . . . SPHYRAENIDAE, LXXIX.
II. Teeth small, subequal; no lateral line.
J. Dorsal spines slender, 4 to 8; anal spine 1. . . . . ATHERINIDAE, LXXVIII.
JJ. Dorsal spines stout, 4; anal spines 2 or 3. . . . . MUGILIDAE, LXXVII.
§§ Pectoral composed of two parts, the lower made up of several free filaments. POLYNEMIDAE, LXXX.
AAAA. Dorsal fin single, of soft rays only (sometimes preceded by fulcra or followed by 4 minute finlets).
K. Tail evidently heterocercal, the last vertebrae turned upward. (Ganoid fishes.)
L. Caudal forked, the lower lobe well developed.
M. Body naked; snout spatulate; mouth wide, preceded by barbels; caudal with fulcra. . . . . POLYODONTIDAE, XXV.
MM. Body with 5 series of bony shields; head with bony shields; mouth inferior, toothless, preceded by 4 barbels; fins with fulcra. . ACIPENSERIDAE, XXVI.
LL. Caudal rounded or lanceolate; head with a bony casque.
N. Scales ganoid (rhombic, enameled plates); no gular plate; fins with fulcra; dorsal fin short. . . . . LEPISOSTEIDAE, XXVII.
NN. Scales cycloid; a bony gular plate; no fulcra; dorsal long. AMIIDAE, XXVIII.

KK. Tail not evidently heterocercal (except in the very young).
O. Scales cycloid.
P. Side of belly with conspicuous ridge or lateral line; pectoral fins inserted high, on or above the axis of body; lower lobe of caudal longer; lower pharyngeals united.
Q. Jaws produced, with sharp unequal teeth. . . . . BELONIDAE, LXII.
QQ. Jaws with minute teeth or none.
R. Dorsal and anal with finlets. . . . . SCOMBERESOCIDAE, LXIII.
RR. Dorsal and anal without finlets.
§ Lower jaw much produced. . . . . HEMIRAMPHIDAE, LXIV.
§§ Lower jaw short, like the upper; pectoral fin long. EXOCOETIDAE, LXV.
PP. Edge of belly without conspicuous ridge or lateral line; pectoral fins inserted usually below axis of body; lower pharyngeals separate; dorsal of soft rays only, inserted posteriorly.
S. Vent before ventrals; eyes rudimentary or wanting. . . AMBLYOPSIDAE, LIX.
SS. Vent behind ventrals; eyes normal.
T. Head more or less scaly.
U. Upper jaw not protractile, its margin formed by maxillaries posteriorly.
V. Teeth cardiform, unequal. . . . . ESOCIDAE, LVI.
VV. Teeth villiform, equal. . . . . UMBRIDAE, LV.
UU. Upper jaw very protractile, its edge formed by premaxillaries alone.
W. Anal fin not modified in the male; species not viviparous. CYPRINODONTIDAE, LVII.
WW. Anal fin modified in the male; species viviparous. POECILIIDAE, LVIII.
TT. Head without scales.
X. Gill membranes united with the isthmus; lower pharyngeals falciform; mouth toothless; anterior vertebrae coalesced.
Y. Pharyngeal teeth larger, in 1 or more rows, the main row with less than 8 teeth; dorsal (in native species) with fewer than 10 rays. CYPRINIDAE, L.
YY. Pharyngeal teeth very numerous, in 1 row; dorsal rays 10 or more. CATOSTOMIDAE, XLIX.
XX. Gill membranes free from the isthmus; lower pharyngeals flattish; anterior vertebrae not modified.
a. Lateral line present.
b. Lower jaw with a gular plate; fins with scaly sheaths.
c. Last ray of dorsal not produced. . . . . ELOPIDAE, XXIX.
cc. Last ray of dorsal much produced; scales very large. . . MEGALOPIDAE, XXX.
bb. Lower jaw without gular plate.
d. Tongue with canine teeth; mouth terminal, oblique. . . . HIODONTIDAE, XXXI.
dd. Tongue with blunt teeth; mouth inferior, horizontal. . . ALBULIDAE, XXXII.
aa. Lateral line wanting.
e. Mouth very wide, the maxillary reaching much beyond eye; snout short. ENGRAULIDAE, XXXVI.
ee. Mouth moderate, or small, the maxillary scarcely extending beyond eye.
f. Belly keeled, with bony plates, large or small.
g. Maxillary narrow, of 2 pieces, mouth small, toothless. DOROSOMIDAE, XXXV.
gg. Maxillary broad, of 3 pieces. . . . . CLUPEIDAE, XXXIV.
ff. Belly rounded, without bony plates. . . . . DUSSUMIERIIDAE, XXXIII.
OO. Scales none; caudal with a long filament; snout long, tubular, with the small mouth at the end. . . . . FISTULARIIDAE, LXVIII.

SERIES II. VENTRAL FINS PRESENT, THORACIC OR JUGULAR

A. Eyes unsymmetrical, both on the same side of the head.
B. Eyes large, well separated; mouth moderate or large; dorsal and anal separate from caudal.
C. Eyes and color on the left side; base of left ventral elongate, extending along ridge of abdomen. . . . . BOTHIDAE, LXXIV.
CC. Eyes and color ~~mostly~~ on the right side; base of ventral not extended along ridge of abdomen.

D. Mouth large; teeth unequal, sharp, some of them canine-like.
HIPPOGLOSSIDAE, LXXII.

DD. Mouth small, with even teeth; no canines. . . . PLEURONECTIDAE, LXXIII.

BB. Eyes very small, close together; mouth small, with weak teeth. (*Soles.*)

§ Eyes on the right side; dorsal and anal separate from caudal; ventrals with long base, the right ventral confluent with the anal. . . . . ACHIRIDAE, LXXV.

§§ Eyes on the left side; vertical fins confluent. . . . . CYNOGLOSSIDAE, LXXVI.

AA. Eyes symmetrical, one on each side of head.

E. Gill openings in front of pectorals.

F. Body more or less scaly, or armed with bony plates.

G. Ventral fins united into one; no lateral line; gill membranes joined to isthmus.
GOBIIDAE, CXXIV.

GG. Ventral fins separate.

H. Top of head with a large sucking disk, modified from the spinous dorsal.
ECHENEIDAE, CXXII.

HH. Top of head without sucking disk.

I. Ventral rays, I, 5.

J. Suborbital with a bony stay which extends across the cheeks to or toward the preopercle; cheeks sometimes entirely bony.

K. Pectoral fin with 2 or 3 lower rays detached and separate.
TRIGLIDAE, CXIX.

KK. Pectoral fin entire; slit behind fourth gill small, or wanting.

L. Dorsal spines 9 to 17; anal spines 3; eyes lateral. SCORPAENIDAE, CXIV.

LL. Dorsal spines 4; eyes superior. . . . . URANOSCOPIDAE, CXXVIII.

JJ. Suborbital stay wanting; cheeks not mailed.

M. Dorsal spines all or nearly all unconnected by membrane.

N. Body elongate, subterete. . . . . RACHYCENTRIDAE, XCIV.

NN. Body oblong or ovate, compressed.

O. Caudal peduncle very slender, the fin widely forked.
SERIOLIDAE, LXXXVIII.

OO. Caudal peduncle stout, the fin little forked.

§ Ventrals well developed in adult. . . CENTROLOPHIDAE, XCI.

§§ Ventrals rudimentary in adult. . . . . STROMATEIDAE, XC.

MM. Dorsal spines, if present, mostly connected by membrane.

P. Dorsal and anal each with 5 or more finlets; scales minute.

Q. Caudal peduncle without median keel (the 2 lesser keels present as usual); dorsals well separated, the interspace more than half head; spinous dorsal short; corselet obsolete; vertebrae normal, about 31 in number; teeth slender, on jaws, vomer and palatines; gill rakers long, numerous. . . . . SCOMBRIDAE, LXXXIV.

QQ. Caudal peduncle with median keel, a small keel above and below this.

R. Teeth of jaws strong, subtriangular, more or less compressed; teeth on vomer and palatines villiform; gill rakers few; body wholly covered with small scales, without distinct "corselet"; vertebrae normal; dorsal spines 14 to 18; dorsals not far separated; body compressed; vertebrae 35 to 50. . . . CYBIIDAE, LXXXV.

RR. Teeth of jaws subconic; gill rakers numerous; corselet distinct; vertebrae normal, or else with trellis-like structure posteriorly.
THUNNIDAE, LXXXVI.

PP. Dorsal and anal without finlets, or with but 1 each.

S. Throat with 2 long barbels. . . . . MULLIDAE, CVIII.

SS. Throat without barbels.

T. Anal preceded by 2 free spines (these often obsolete with age).

U. Scales small, cycloid. . . . . CARANGIDAE, LXXXVII.

UU. Scales moderate, ctenoid. . . . . POMATOMIDAE, LXXXIX.

TT. Anal without free spines.

V. Tail with a fleshy keel on each side. . SERIOLIDAE, LXXXVIII.

VV. Tail not keeled.

W. Dorsal fin very long, without distinct spines; caudal deeply forked. . . . . CORYPHAENIDAE, XCIII.

WW. Dorsal fin with distinct but very flexible spines; gill membranes united to isthmus.
§ Ventral fins close together; preopercle with a weak spine or none; no lateral line. . . Eleotridae, CXXIII.
§§ Ventral fins widely separated; preopercle with a very strong spine; lateral line present.
Callionymidae, CXXVII.

WWW. Dorsal fin with distinct and generally stiff spines; gill membranes free from isthmus.
X. Vomer with teeth.
Y. Anal spines none; eyes on top of head.
Uranoscopidae, CXXVIII.
YY. Anal spines 1 or 2.
Z. Anal rays more than 20. . Pomatomidae, LXXXIX.
ZZ. Anal rays fewer than 20.
§ Branchiostegals 7; bones of head serrate. . . . . Percidae, XCVIII. 170
§§ Branchiostegals 6; bones of head nearly or quite entire; size small.
Etheostomidae, XCVII. 152
YYY. Anal spines 3.
§ Pseudobranchiae small, fleshy, covered by skin.
Centrarchidae, XCV. 144
§§ Pseudobranchiae large, exposed.

a. Maxillary slipping under preorbital for its whole length.
§ Anal soft rays fewer than 14. . . . . Lutianidae, CIII. 174
§§ Anal soft rays more than 14. . . . . Nomeidae, XCII.

aa. Maxillary not slipping under preorbital for its whole length.
§ Dorsals separate or nearly so; maxillary without supplemental bone.
Moronidae, XCIX. 171
§§ Dorsal single, without deep notch; maxillary without supplemental bone.
Serranidae, C. 172
§§§ Dorsal single, without deep notch; maxillary with supplemental bone.
Epinephelidae, CI.
YYYY. Anal spines 4 to 10. . . . Centrarchidae, XCV. 142
XX. Vomer without teeth.

b. Teeth more or less setiform (toothbrush-like); soft parts of vertical fins densely scaly; body elevated.
§ Teeth scarcely brush-like; dorsal deeply notched. . . . . Ephippidae, CXI.
§§ Teeth brush-like; dorsal scarcely notched. . . . . Chaetodontidae, CXII.

bb. Teeth not setiform.
c. Lateral line obsolete; dorsal spines about 4; size minute. . Elassomidae, XCVI.
cc. Lateral line present.
d. Anal spines 1 or 2; a large slit behind 4th gill.
e. Lateral line extending on caudal fin; snout scaly. . . . . Sciaenidae, CIX.
ee. Lateral line not extending on caudal fin; snout scaleless.
§ Dorsal single; marine fishes. . . . . Branchiostegidae, CVII.
§§ Dorsals 2; small fresh-water fishes. . . . . Etheostomidae, XCVII.
dd. Anal spines 3.
f. Slit behind 4th gill none; lower pharyngeals completely united; jaws with canines in front; teeth of jaws separate. . . . . Labridae, CXIII.
ff. Slit behind 4th gill large.
g. Anal with more than 15 soft rays; preopercle serrate.
§ Ventrals well developed in adult. . . . . Centrolophidae, XCI.
§§ Ventrals rudimentary in adult. . . . . Stromateidae, XC.
gg. Anal with fewer than 15 soft rays.
h. Maxillary slipping beneath the broad preorbital for its whole length; dorsal spines more than 10.
i. Teeth strong; intestines short.
§ No molar teeth. . . . . Haemulidae, CIV.
§§ Some molars on sides of jaws. . . . . Sparidae, CV.
ii. Teeth slender and weak; intestines elongate. . . . Kyphosidae, CVI.
hh. Maxillary not slipping beneath the narrow preorbital.

j. Dorsal spines 12; premaxillaries moderately protractile; pseudobranchiae large. . . . . LOBOTIDAE, CII.

jj. Dorsal spines 9 or 10; premaxillaries extremely protractile; pseudobranchiae concealed. . . . . GERRIDAE, CX.

II. Ventral fins with or without spine; the number of rays not I, 5.

k. Upper jaw prolonged in a sword. . . . . ISTIOPHORIDAE, LXXXI.

kk. Upper jaw not sword-like.

l. Dorsal fin low, of spines only.

x. Ventrals minute. . . . . PHOLIDAE, CXXX.

xx. Ventrals well developed . . . . . STICHAEIDAE, CXXXI.

ll. Dorsal fin of spines anteriorly, of soft rays posteriorly.

m. Ventral rays 7; vent anterior; dorsal spines 3 or 4. . APHREDODERIDAE, LXI.

mm. Ventral rays I, 1 or I, 2; dorsal spines free; vent normal; body mailed. GASTEROSTEIDAE, LXVII.

mmm. Ventral rays I, 4; body scaly; pectoral fin divided to base in 2 unequal parts. DACTYLOPTERIDAE, CXVIII.

lll. Dorsal of soft rays anteriorly, with low spines posteriorly. . ZOARCIDAE, CXXIV.

llll. Dorsal fin of soft rays only.

n. Dorsal fin very short; body mailed. . . . . AGONIDAE, CXVII.

nn. Dorsal fin very long; body with small scales.

o. Dorsal and anal joined to the caudal.

p. Gill membranes free from the isthmus.

§ Ventrals very slender, barbel-like. . . . . OPHIDIIDAE, CXXXV.

§§ Ventrals normally broad. . . . . CORYPHAENOIDIDAE, LXX.

pp. Gill membranes united to the isthmus. . . . . ZOARCIDAE, CXXXIV.

oo. Dorsal and anal free from caudal; tail isocercal. . . . . GADIDAE, LXIX.

FF. Body scaleless, smooth or more or less prickly or warty.

q. Breast with a sucking disk.

r. Gill membranes free from isthmus; no spinous dorsal; sucking disk between the ventrals. . . . . GOBIESOCIDAE, CXXVI.

rr. Gill membranes attached to the isthmus; sucking disk formed of the ventrals.

s. Skin smooth. . . . . LIPARIDAE, CXX.

ss. Skin warty. . . . . CYCLOPTERIDAE, CXXI.

qq. Breast without sucking disk.

t. Ventrals completely united. . . . . GOBIIDAE, CXXIV.

tt. Ventrals separate.

u. Ventral rays, I, 5.

v. Dorsal and anal with finlets. . . . . SCOMBRIDAE, LXXXIV.

vv. Dorsal and anal without finlets; 2 free anal spines. CARANGIDAE, LXXXVII.

uu. Ventral rays fewer than I, 5.

w. Upper jaw prolonged into a sword. . . . . ISTIOPHORIDAE, LXXXI.

ww. Upper jaw not prolonged into a sword.

x. Suborbital with a bony stay.

y. Dorsal spines stiff and isolated. . . . . GASTEROSTEIDAE, LXVII.

yy. Dorsal spines flexible and connected by membranes.

§ Spinous dorsal with fewer than 14 rays, and shorter than soft part. COTTIDAE, CXV.

§§ Spinous dorsal with 14 to 16 spines, longer than soft part. HEMITRIPTERIDAE, CXVI.

xx. Suborbital without bony stay.

§. Dorsal spines 2 or 3; teeth strong. . . . . BATRACHOIDIDAE, CXXV.

§§. Dorsal spines numerous; teeth comb-like. . . . . BLENNIIDAE, CXXIX.

EE. Gill openings small, behind the pectoral fins, which are pediculate.

z. Gill openings in or behind lower axil of pectorals; mouth large, terminal.

§. Pseudobranchiae present; head broad, depressed; mouth very large, with large unequal teeth. . . . . LOPHIIDAE, CXLV.

§§. Pseudobranchiae none; head compressed; teeth small. . ANTENNARIIDAE, CXLIV.

zz. Gill openings in or behind upper axil of pectorals; mouth small, below a projecting snout. OGCOCEPHALIDAE, CXLIII.

Series III. Ventral Fins Entirely Wanting

A. Gill membranes joined to the isthmus, so that the gill openings of the 2 sides are not connected.
B. Dorsal fin single, of spines only (these sometimes slender, like soft rays).
C. Molar teeth present. . . . . Anarhichadidae, CXXXIII.
CC. Molar teeth none.
D. Mouth vertical; body naked. . . . . Cryptacanthodidae, CXXXII.
DD. Mouth not vertical; body scaly. . . . . Pholidae, CXXI.
BB. Dorsal fins 2, the anterior spinous; teeth incisor-like.
E. Skin covered with osseous plates. . . . . Balistidae, CXXXVII.
EE. Skin covered with fine shagreen. . . . . Monacanthidae, CXXXVIII.
BBB. Dorsal fin single, of soft rays only.
F. Snout tubular, bearing the short toothless jaws at the end; body mailed.
Syngnathidae, LXVI.
FF. Snout not tubular.
G. Body elongate, eel-shaped; maxillaries and premaxillaries coalescent with vomer and palatines.
H. Gill openings developed as wide slits; pectoral fins developed.
I. Jaws broad, not bill-like.
J. Skin covered with linear imbedded scales, set at right angles with one another.
K. Teeth sharp, in villiform bands in jaws; gill openings lateral.
Anguillidae, XLII.
KK. Teeth blunt, in two rows in jaws; gill openings ventral.
Simenchelyidae, XLIII.
JJ. Skin scaleless.
L. Dorsals and anal fins confluent around tip of tail.
M. Posterior nostril well above upper lip; tongue free at front and sides.
Congridae, XLIV.
MM. Posterior nostril very close to upper lip; tongue more or less completely adnate. . . . . Myridae, XLV.
LL. Fleshy tip of tail projecting beyond vertical fins.
Ophichthyidae, XLVI.
II. Jaws excessively slender, bill-like. . . . . Nemichthyidae, XLVII.
HH. Gill openings small and round; no pectoral fins. . . Muraenidae, XLVIII.
GG. Body not eel-shaped.
N. Breast with a sucking disk.
O. Skin smooth. . . . . Liparidae, CXX.
OO. Skin warty. . . . . Cyclopteridae, CXXI.
NN. Breast without sucking disk.
P. Teeth in each jaw confluent into one.
Q. Body compressed, the skin rough. . . . . Molidae, CXLI.
QQ. Body not compressed, armed with spines. . . . Diodontidae, CXL.
PP. Teeth in each jaw confluent into two. . . Tetraodontidae, CXXXIX.
PPP. Teeth separate, body in a bony casque. . . . . Ostraciidae, CXLII.
AA. Gill membranes free from the isthmus.
R. Vent at the throat; vertical fins separate. . . . . Amblyopsidae, LII.
RR. Vent normal.
S. Caudal fin wanting; body naked. . . . . Trichiuridae, LXXXIII.
SS. Caudal fin present.
T. Upper jaw produced in a sword. . . . . Xiphiidae, LXXXII.
TT. Upper jaw without sword.
U. Body ovate, much compressed. . . . . Stromateidae, XC.
UU. Body oblong or elongate; gill membranes not united.
V. Jaws toothless, the lower projecting. . . . . Ammodytidae, CXXXVI.
VV. Jaws with teeth, the lower not projecting. . . . . Ophidiidae, CXXXV.

Superorder GANOIDEI (The Ganoid Fishes)

The name *Ganoidei* was first used by Agassiz for those fishes which are armed with bony plates instead of regular cycloid or ctenoid scales. This arrangement included forms long extinct. The *Ostracophori*, *Arthrodira*, and other Paleozoic forms having no visible affinity with the more recent Ganoids have been so called. As now defined, the group is natural, the living species agreeing in the presence of certain traits. Johannes Müller, one of the greatest of systematic zoölogists, restricted the group to those fishes which show more or less distinct reptilian or batrachian affinities of a solid optic chiasma, several valves in the arterial bulb, and a more or less developed spiral valve in the rectum, but none of these characters can be verified in the extinct forms. It seems to us more natural not to regard the Ganoids as a separate class or subclass, but to unite them with the other Pisces. (Gr., *γάνος*, splendor, from the enameled scales.)

Order VIII. SELACHOSTOMI

This order contains but one family. (Gr., *σέλαχη*, shark or other cartilaginous fish ; *στόμα*, mouth.)

Family XXV. POLYODONTIDAE (The Paddlefishes)

Body fusiform, the skin mostly smooth ; snout prolonged in a flat, spatulate blade, which overhangs the broad, terminal mouth ; the "spatula" with a reticulated framework; teeth very numerous, minute, disappearing with age ; opercle rudimentary, its skin produced in a long flap ; gills $4\frac{1}{2}$; no pseudobranchiae ; gill rakers very long, in 2 rows, separated by membrane ; gill membranes connected, free from isthmus ; one branchiostegal ; spiracles present. C. fin with fulcra ; D. posterior ; tail heterocercal, the lower lobe nearly as long as the upper ; sides of tail with rhombic plates ; air bladder large, cellular ; stomach caecal, the pyloric caeca forming a branching, leaf-like organ. Singular fishes, feeding on minute organisms. The long oar-like snout seems to be a sensory organ. Two species, *Psephurus gladius* of rivers of China, and the following :

a. Gill rakers very fine and numerous; caudal fulcra many, small. . . . Polyodon, 43.

43. POLYODON (Lacépède) Bloch & Schneider

(Gr., *πολύς*, many ; *ὀδών*, tooth)

55. **P. spathula** (Walbaum). Paddlefish. Spoonbill. Duck-billed Cat. Olivaceous ; opercular flap in adult reaching V.; head with flap and spatula more than half length. D. 55 ; A. 57 ; V. 45. L. 6 feet. Miss. Valley ; common in larger streams. (*P. folium* Lac.) (Lat., spatula.)

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Order IX. GLANIOSTOMI

This order contains only the family of Sturgeons. (Gr., γλάνις, catfish; στόμα, mouth.)

Family XXVI. ACIPENSERIDAE (The Sturgeons)

Body elongate, fusiform, with 5 rows of bony keeled shields, the skin between these rows with small or minute plates; snout produced; mouth inferior, protractile, toothless; 4 barbels in a cross-row before mouth; gills 4; an accessory opercular gill; no branchiostegals; head covered by bony plates joined by sutures; gill membranes joined to isthmus; vertical fins with fulcra; dorsal and anal posterior; tail heterocercal; air bladder large, simple; stomach not caecal, with pyloric appendages; rectum with spiral valve. Seas and rivers of northern regions; feeding on small animals and plants sucked in through the tube-like mouth. Species about 20.

The sturgeons change considerably with age. The snout becomes shorter and blunter, the shields smoother, and some of the shields become largely absorbed in old age.

a. Spiracles present; snout subconic; rows of bony shields nowhere confluent; tail not depressed or mailed; gill rakers lanceolate. (*Acipenserinae.*) . . . Acipenser, 44.

aa. Spiracles obsolete; snout shovel-shaped, depressed above; rows of bony shields coalescent behind the dorsal, so that the depressed tail is completely mailed; gill rakers small, fan-shaped, ending in 2 to 4 points. Caudal peduncle lengthened, depressed, broader than deep, completely armored; scutes of back with their points posterior, sharp; lips 4-lobed, each lip bearing 4 clusters of flattened, tubercle-like lappets. (*Scaphirhynchinae.*)

b. Belly and breast covered with subrhomboid plates; snout moderate, not much longer than rest of head; air bladder longer (5 in body); color pale olive-gray. Scaphirhynchus, 45.

bb. Belly and breast naked; snout much longer than rest of head; ribs 20 or 21; air bladder short (8 in body); color white . . . . . Parascaphirhynchus, 46.

44. ACIPENSER (Artedi) Linnaeus (Sturgeons) (a Latin name)

a. Plates between vent and A. large, in 1 or 2 rows; space between dorsal and lateral shields with stellate plates of moderate size in 5 to 10 series; last dorsal shield of moderate size, more than half length of one before it; dorsal shields with the spine inserted not far behind the center.

56. **A. oxyrhynchus** Mitchill. Common Sturgeon. American Sturgeon. First dorsal fulcrum somewhat enlarged, its surface rough; dorsal shields 9 to 11; lateral shields 27 to 29; ventral 9 or 10; 2 rows of 2 shields each, with 1 median shield between vent and anal. D. 40; A. 26; L. 8 to 12 feet. N. Atl., ascending rivers; commonest N., S. to S. C. A very important food fish now, like all other sturgeons becoming rapidly scarce. The American form, with fewer lateral shields, is scarcely distinct from the European *Acipenser sturio* Linnaeus, which has 30 or more lateral shields. (Gr., ὀξύς, sharp; ῥύγχος, snout.)

bb. Space between dorsal and lateral shields with minute plates in very many series.

c. Last dorsal shield of moderate size, more than half length of next to the last; dorsal shields 15 or 16; species fluviatile.

57. **A. fulvescens** Rafinesque. Lake Sturgeon. River Sturgeon. First dorsal fulcrum slightly enlarged; dorsal shields 15; lateral 38; ventral 10; 3 shields in a single row between anal fin and vent. D. 42; A. 27. Changes greatly with age, the young with sharp snout and very rough shields and the spines strongly hooked; the adult with blunt snout and small smooth shields, most of them finally lost. L. 6 feet. Miss. Valley, Great Lakes, and N.; once very abundant, ascending rivers in spring, but not entering the sea. Many nominal species have been described by Duméril and others, but I fail to discriminate them. (*A. rubicundus* Le Sueur.) (Lat., *fulvescens*, yellowish brown.)

cc. Last dorsal shield very small, less than half length of next to the last; dorsal shields 10 to 12; marine.

58. **A. brevirostrum** Le Sueur. Short-nosed Sturgeon. Southern Sturgeon. Snout short, bluntish, much shorter than rest of head; dorsal shields 11; lateral 30; ventral 9; 1 shield between anal and vent. D. 43; A. 24. Fla. to Cape Cod; scarce. (Lat., *brevis*, short; *rostrum*, snout.)

45. SCAPHIRHYNCHUS Heckel

(*Scaphirhynchops* Gill, the name *Scaphorhynchus* being earlier given to a genus of birds) (Gr., σκάφη, spade; ῥύγχος, snout)

59. **S. platorhynchus** (Rafinesque). Shovel-nosed Sturgeon. Switchtail. Body elongate, tapering into the slender depressed tail, which extends in the young beyond C. as a slender filament; shields sharply keeled; dorsal shields 15 to 18; lateral, 41 to 46; ventral, 11 to 13. L. 5 feet. Miss. Valley, etc.; common. (Gr., πλατύς, flat; ῥύγχος, snout.)

46. PARASCAPHIRHYNCHUS Forbes & Richardson

60. **P. albus** Forbes & Richardson. White Sturgeon. Color light gray to milky white. Snout very long; eye minute; scutes more numerous and gill rakers fewer than in *Scaphirhynchus*. Head 3; depth about 8. Dorsal scutes 16 to 19; lateral, 41 to 47; ventral, 10 to 13; scutes sharp-pointed. L. 4½ feet; weight 16 lb. Illinois R. and lower Missouri; not common.

Order X. GINGLYMODI

This order, defined on page 23, contains but one family among recent fishes, although it has many allies among extinct forms. (Gr., γίγγλυμος, hinge; ὀδούς, tooth.)

Family XXVII. LEPISOSTEIDAE (The Garfishes)

Body subcylindrical, covered with rhombic enameled "ganoid" scales, imbricated in oblique series which run downward and backward. Jaws both

elongate, the upper always projecting ; premaxillary forming most of upper jaw, the maxillary transversely divided into several pieces ; lower jaw formed much as in reptiles ; both jaws with an outer series of small teeth followed by 1 or 2 series of larger teeth of peculiar structure ; close-set, rasp-like teeth on jaws, vomer, and palatines ; tongue toothless, broad, emarginate ; external bones of head very hard, rugose. Eyes moderate ; nostrils near end of snout ; pseudobranchiae present, besides an opercular gill ; B. 3 ; no spiracles ; air bladder cellular, joined by a glottis to the esophagus, resembling the lungs of reptiles, and used in respiration. Fins with fulcra ; D. short, nearly opposite A. ; tail heterocercal, produced as a filament in young ; vertebrae with ball and socket joint, as in reptiles ; pyloric caeca many. Singular fishes inhabiting the lakes and larger rivers of eastern North America. The species are extremely variable in coloration, length of snout, proportions, etc., a fact which has given rise to several specific names, most of them at present discredited.

a. Snout very long and narrow, more than twice length of rest of head ; palatine band of teeth uniform. . . . . LEPISOSTEUS, 47.

aa. Snout broad, of moderate length, not longer than rest of head ; palatine teeth uneven.

b. Large teeth of upper jaw in a single row on each side ; cleft of mouth to rictus longer than rest of head. . . . . CYLINDROSTEUS, 48.

bb. Large teeth of upper jaw in 2 rows on each side, some of them movable ; cleft of mouth to rictus not longer than rest of head. . . . . ATRACTOSTEUS, 49

47. LEPISOSTEUS[1] Lacépède (LONG-NOSED GARS)

(Gr., λεπίς, scale ; ὀστέον, bone)

61. **L. osseus** (Linnaeus).[2] LONG-NOSED GAR. COMMON GAR-PIKE. Opercle longer than high. Snout $1\frac{3}{8}$ to $1\frac{7}{8}$ in head, these numbers all varying somewhat ; eye $1\frac{1}{3}$ to $1\frac{7}{8}$ in opercle. Olivaceous ; vertical fins and posterior parts of body with large black spots. Head $2\frac{1}{2}$ to $3\frac{1}{3}$; depth 3 to 5. D. 8 ; A. 9 ; P. 12. Scales 62, around middle of trunk 39, before dorsal 51. Great Lakes to La. ; abundant, especially N. (Lat., bony.)

48. CYLINDROSTEUS Rafinesque (SHORT-NOSED GARS)

(Gr., κυλίνδρος, cylinder ; ὀστέον, bone)

62. **C. platostomus** (Rafinesque). SHORT-NOSED GAR. Head $3\frac{1}{3}$; depth $2\frac{1}{4}$ in head. D. 7 ; A. 8. Scales 62, before dorsal 54, around trunk 48 ; snout $1\frac{3}{5}$ in head. Spots numerous, variable. L. 3 feet. Great Lakes and S. ; generally common, especially in Mississippi Valley. (Gr., πλάτος, flat ; στόμα, mouth.)

49. ATRACTOSTEUS Rafinesque (ALLIGATOR GARS)

(Gr., ἀτρακτός, spindle)

63. **A. tristoechus** (Schneider). ALLIGATOR GAR. MANJUARI. Head $3\frac{3}{4}$; depth 3 in head. Eye $2\frac{3}{5}$ in opercle. Scales 62, before dorsal 52, around

[1] This name is usually corrected to *Lepidosteus*, but *Lepisosteus* is the original spelling.

[2] The early name, *L. oxyurus* Rafinesque, belongs to some species of *Cylindrosteus*, probably *C. platostomus*.

trunk 60 ; snout $1\frac{4}{5}$ in head. L. 8 to 10 feet. Fins unspotted. Miss. Valley N. to Ohio ; abundant southward. Largest of the Gars, a huge, muscular, voracious fish, useless as food, remarkable for its armature of enameled scales. (Gr., *τρεῖς*, three; *στοῖχος*, row.)

Order XI. HALECOMORPHI (The Bowfins)

This group, characterized on page 23, contains a single family among recent fishes. (Lat., *halec*, herring ; Gr., *μορφή*, form.)

Family XXVIII. AMIIDAE (The Bowfins)

Body oblong, robust, with thick cycloid scales. Head sub-conical, bluntish, covered above by a very hard bony helmet ; lateral margins of upper jaws formed by the maxillaries, which are divided by a lengthwise suture. Mouth horizontal, its cleft extending beyond the small eye ; lower jaw broad, a broad bony striated gular plate placed between its rami ; premaxillaries not protractile ; jaws each with an outer series of conical teeth, behind them in the lower a band of rasp-like teeth ; small teeth on vomer, palatines, and pterygoids; anterior nostril with a short barbel ; cheek with a bony shield. B. 10 to 12. No pseudobranchiae or opercular gill ; 2 lanceolate striate appendages on each side of isthmus ; gill rakers very short, stout. Lateral line present. Dorsal fin long and low, nearly uniform ; no fulcra ; anal fin short ; tail heterocercal. Vertebrae double-convex, as usual among fishes. Air bladder somewhat as in the *Dipneusti* and *Amphibia*, cellular, bifid in front, connected by a glottis with the pharynx. No closed oviduct ; no pyloric caeca. One species known, in the lakes and sluggish waters of North America, — a voracious fish, remarkably tenacious of life, and with soft and pasty ill-flavored flesh.

50. AMIA Linnaeus (*Amiatus*[1] Rafinesque)

(Gr., *ἀμία*, ancient name of some mackerel-like fish)

64. **A. calva** Linnaeus. Bowfin. Mudfish. Dogfish. "John A. Grindle." Blackish olive, sides with greenish reticulations, lower side of head with dark spots ; ♂ with a black ocellus edged with orange at base of C. above. Head $3\frac{3}{4}$; depth 4. D. 48 ; A. 11. Lat. l. 67. ♂ 20 inches ; ♀ 30. Swamps and lakes, Vt. to Dakotas, Fla., and Texas ; abundant in lowlands. A fish of great interest to zoölogists, from its relation to earlier types. (Lat., bald.)

Superorder TELEOSTEI

We now take up the series of *Teleostei* proper, or true bony fishes, a group comprising the great majority of existing fishes. It is apparently descended from the Ganoid type, the *Isospondyli* being allies of or descendants of precursors of the *Halecomorphi*. As a whole, the *Teleostei* differ from the Ganoids

[1] The name *Amia* was given earlier to another fish by Gronow, but not in binomial form.

in the more perfectly ossified skeleton, the less heterocercal tail, the degradation of the air bladder and the arterial bulb, and in the simplicity of the optic chiasma.

The *Teleostei* are divisible into two great groups, with rather ill-defined boundaries — the *Physostomi*, or soft-rayed fishes, and the *Physoclysti*, or spiny-rayed. The members of the former group have throughout life a slender duct, by which the air bladder is joined to the alimentary canal. In most cases the fin rays are soft, the ventrals abdominal, the pectorals placed low, and the scales cycloid. Although the typical *Physostomi* differ in many ways from the more specialized *Physoclysti*, yet as we approach the junction of the two groups the subordinate differences disappear, leaving finally the presence of the air duct in *Physostomi* as the only differential character. In view of this close relation of the two groups, several writers, following Professor Gill, have removed as separate orders various aberrant forms, leaving the bulk of both groups in one large order, *Teleocephali*, with numerous suborders. We prefer to regard most of these suborders as distinct orders rather than to treat the heterogeneous group of *Teleocephali* as an "order." (Gr., *τέλεος*, perfect; *ὀστέον*, bone.)

Order XII. ISOSPONDYLI (Salmon, Herring, etc.)

This order contains a great variety of soft-rayed fishes, which agree in lacking the modified vertebrae and the falciform pharyngeals of the *Ostariophysi* and in having the sides of the upper jaw formed by the maxillaries. They have also the precoracoid arch of the shoulder girdle, which is lost in the *Haplomi* and in the perch-like fishes. There are some 25 families — most of them marine, some anadromous, and some of them in the deep seas. (Gr., *ἴσος*, equal; *σπόνδυλος*, vertebra.)

Family XXIX. ELOPIDAE (The Ten-pounders)

Body elongate, more or less compressed, covered with silvery, cycloid scales; mouth large, terminal, the lower jaw prominent; maxillary long, of 3 pieces, forming side of upper jaw; an elongate bony plate between branches of lower jaw (as in *Amia*); bones of mouth almost all with villiform teeth; eye large, with an adipose eyelid; gill rakers long and slender; belly not compressed, covered with ordinary scales; D. over or behind V.; C. forked; no adipose fin. Species few, in warm seas; many extinct genera are recorded, some with strong canines.

a. Body elongate, with small scales; A. smaller than D.; pseudobranchiae present.

Elops, 51.

51. ELOPS Linnaeus (Gr., *ἔλοψ*, name of some sea fish)

65. **E. saurus** Linnaeus. Ten-pounder. Gular plate about 3 times as long as broad; eye large; tail very long; C. deeply forked. Silvery, darker above. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$. D. 20; A. 13. Scales 12–120–13. L. 36.

Cape Cod and S., along our coast. Remarkable for the development of membranous sheaths at bases of fins and elsewhere. (Gr., *σαῦρος*, name of some sea fish.)

Family XXX. MEGALOPIDAE (The Tarpons)

Body oblong, compressed, with very large scales; no pseudobranchiae; last ray of dorsal produced in a long filament. Two genera, each of one species, large fishes, in tropical seas.

a. Insertion of dorsal notably behind ventrals; Atlantic species. . . . . Tarpon, 52.

52. TARPON Jordan & Evermann (Vernacular name)

66. **T. atlanticus** (Cuvier & Valenciennes). Tarpon. Grande Écaille. Sabalo. Mouth large, its cleft oblique, extending beyond the very large eye; lower jaw very prominent; D. inserted behind V.; dorsal filament as long as head. Brilliantly silvery. Head 4; depth 4. D. 12; A. 20. Lat. l. 42. L. 6 feet. W. I. and Gulf Coast, occasional N. to Nova Scotia; abundant about Fla.; spawns farther S. Remarkable for its enormous scales, sometimes 3 inches across; much esteemed as a game fish. (Low Lat., Atlantic.)

Family XXXI. HIODONTIDAE (The Moon-eyes)

Body oblong, much compressed, covered with large, silvery, cycloid scales; head naked; mouth terminal, oblique; margin of upper jaw formed by maxillaries; maxillaries entire; no barbels; no adipose fin; lateral line distinct; abdomen compressed, not serrated; moderate-sized teeth on jaws, vomer, sphenoid, hyoid, pterygoid, and palatine bones; tongue with sharp canines; gill rakers few, short, thick; eye very large; gill openings wide; one pyloric appendage; air bladder simple; no oviducts. Three species, inhabiting our Western streams and the Great Lakes; handsome fishes, one of them valued as food.

a. Dorsal fin small, of 9 developed rays only, inserted behind ventrals; belly strongly carinate both before and behind ventrals. . . . . Amphiodon, 53.

aa. Dorsal of 12 developed rays, inserted ~~before~~ behind ventrals; belly before ventrals not carinate. Hiodon, 54.

53. AMPHIODON Rafinesque (*Elattonistius* Gill & Jordan) (Gold Eyes)

(Gr., *ἀμφι*, everywhere; *ὀδόνς*, tooth.)

67. **A. alosoides**[1] (Rafinesque). Gold-eye. Body deep, closely compressed; snout blunter than in other species; eye bright golden yellow in life, moderate, $3\frac{1}{4}$ in head; P. short, nearly as long as head, about reaching V.; longest dorsal ray about half longer than base of fin. Sides with golden luster. Head $4\frac{1}{2}$; depth $3\frac{1}{2}$. D. 9; A. 32. Scales 6–56–9. L. 12. Ohio Valley to Saskatchewan R.; common N. One of the finest of food fishes in Manitoba. (Lat., *alosa*, shad; Gr., *εἶδος*, form.)

[1] The name misprinted *alveoides* by Rafinesque.

54. HIODON Le Sueur (Moon-eyes)

(Gr., ὑοειδής, hyoid (tongue bone); ὀδόυς, tooth)

a. Belly carinate between V. and A.

68. **H. tergisus** Le Sueur. Moon-eye. Snout rounded, shorter than the large silvery eye, which is $3\frac{1}{3}$ in head. Olivaceous; sides brilliantly silvery. Head $4\frac{1}{3}$; depth 3. D. 12; A. 28. Scales 5–56–7. L. 15. Great Lakes and Miss. Valley; abundant. One of our most beautiful fresh-water fishes, not much valued as food, the flesh being rather tasteless and bony. (Lat., polished.)

aa. Belly nowhere carinate.

69. **H. selenops** Jordan & Bean. Body elongate, less compressed; eye very large, $2\frac{1}{2}$ in head. Silvery. Head $4\frac{1}{3}$; depth 4. D. 12; A. 27. Cumberland R. to Ala. (Gr., σελήνη, moon; ὤψ, eye.)

Family XXXII. ALBULIDAE (The Ladyfishes)

Body elongate, little compressed, covered with small, silvery scales; head naked; snout conic, pig-like, overhanging the small, inferior mouth; maxillary short, with supplemental bone; preorbital very broad; sides of upper jaw formed by maxillaries; eye large, with an adipose eyelid; gill rakers tubercle-like; preopercle with membranous edge; villiform teeth on jaws, vomer, and palatines; coarse blunt teeth on tongue and roof of mouth; lateral line present; belly flattish, not carinate; D. moderate, inserted before V.; A. very small; no adipose fin; C. forked. Species few; in most warm seas.

55. ALBULA (Gronow) Bloch & Schneider (Lat., *albus*, white)

70. **A. vulpes** (Linnaeus). Ladyfish. Bonefish. Macabi. A band of elongate scales along middle of back. Brilliantly silvery. Head $3\frac{3}{4}$; depth 4. D. 15; A. 8. Scales 9–71–7. L. 30. Warm seas, N. to Cape Cod. (Lat., fox.)

Family XXXIII. DUSSUMIERIIDAE (The Round Herrings)

Small, herring-like fishes of the tropics, distinguished by the rounded belly outline, there being no ventral scutes.

56. ETRUMEUS Bleeker (From the Japanese name *Urumai-iwashi*)

71. **E. sadina** (Mitchill). Round Herring. Mouth small, reaching front of orbit; eye large; fins all very small. Bluish; sides silvery. Head 4; depth 6. D. 18; A. 13. L. 5. Me. to Fla.; scarce. (*Alosa teres* De Kay.) (Corruption of sardine.)

Family XXXIV. CLUPEIDAE (The Herrings)

Body oblong, covered with cycloid scales; head naked; side of upper jaw formed by maxillaries; mouth terminal, the lower jaw about as long as upper;

maxillaries large, composed of 3 pieces; teeth feeble or wanting; dorsal moderate; anal often very long; caudal forked; no lateral line; no gular plate; belly compressed, more or less serrated; branchiostegals 6 to 15; the tips of the larger ones abruptly truncate; stomach not gizzard-like. Carnivorous fishes, of feeble organization; pseudobranchiae present; flesh filled with small bones; gill rakers long and slender; gill openings wide. Species numerous; found in most seas; many species entering fresh waters to spawn, a few remaining permanently. Many are highly valued as food fishes. It is probable that the *Clupeidae* are more numerous in individuals than any other family of fishes.

a. Anal fin moderate, its rays 15 to 25; dorsal nearly opposite ventrals. (*Clupeinae.*)
  b. Scales with their posterior edges entire and rounded.
    c. Last ray of D. not produced; scales loosely attached.
      d. Vomer with feeble teeth; ventral scutes very weak, sometimes scarcely appreciable; ventrals inserted below middle of dorsal; vertebrae 50 to 56; marine species not entering rivers. . . . . CLUPEA, 57.
      dd. Vomer without teeth.
        e. Ventral scutes very feeble; body slender; vertebrae 52; opercle and preopercle scarcely striate; ventrals below middle of dorsal; marine species. SARDINELLA, 61.
        ee. Ventral scutes strong; belly compressed.
          f. Vertebrae 46 to 50; anadromous species, spawning in streams.
            g. Premaxillaries meeting at a broad angle, so that the tip of the jaw appears not notched; lower jaw more or less projecting; cheeks longer than deep; no wing-like scales at base of C. . . . . POMOLOBUS, 58.
            gg. Premaxillaries meeting in front at a very acute angle, the notched tip of the upper jaw receiving the mandible; cheeks deeper than long; no teeth; a pair of wing-like scales at base of C. . . . . ALOSA, 59.
          ff. Vertebrae 40 to 44; species spawning in salt water. . . HARENGULA, 60.
    cc. Last ray of dorsal produced in a long filament; vertebrae 48; marine. OPISTHONEMA, 62.
  bb. Scales with their posterior margins vertical and pectinate or fluted; head very large; dorsal small, posterior; gill rakers very numerous, about 70. . . BREVOORTIA, 63.
aa. Anal fin very long, of more than 30 rays; D. fin inserted behind ventrals. (*Opisthopterinae.*) NEOSTEUS, 64.

57. **CLUPEA** (Artedi) Linnaeus (Lat., herring)

72. **C. harengus** Linnaeus. ATLANTIC HERRING. Body elongate, the scales deciduous; serratures on belly very weak, almost obsolete; cheeks longer than high; vomer with a small ovate patch of teeth; upper jaw scarcely emarginate; gill rakers 40 on lower part of arch; D. inserted before V.; lower fins small; peritoneum dusky. Blue; silvery on sides. Head $4\frac{1}{2}$; depth $4\frac{1}{3}$. D. 18; A. 17. Lat. l. 57. Scutes 28 + 13. L. 12. N. Atl., everywhere, S. to N. C.; spawns in the sea. (*Eu.*) (Low Latin, herring.)

58. **POMOLOBUS** Rafinesque (Gr., πώμα, opercle; λόβος, lobe)

a. Gill rakers 40 to 50; lower jaw moderately prominent; teeth mostly disappearing with age, a small patch on tongue. (*Alausella* Gill.)
  b. Peritoneum pale.

73. **P. pseudoharengus** (Wilson). ALEWIFE. GASPEREAU. SAW-BELLY. BRANCH HERRING. WALL-EYED HERRING. Body deep, heavy forward; head short, nearly as deep as long; eye large, $3\frac{1}{2}$ in head; gill rakers long, about 35 below arch; first ray of D. about equal to base of fin; lower lobe of C. longer; fins rather high. Bluish; sides silvery, with faint dark streaks along rows of scales; a round dark spot at shoulder. Head $4\frac{2}{3}$; depth $3\frac{1}{3}$. D. 16; A. 19. Lat. l. 50. Scutes 21 + 14. L. 15. Newfoundland to Fla.; abundant; entering streams to spawn; landlocked in lakes of W. N. Y. (*Clupea vernalis* Mitchill.) (Gr., *ψεῦδης*, false; *harengus*, herring.)

bb. Peritoneum black.

74. **P. aestivalis** (Mitchill). GLUT HERRING. BLUEBACK. BLACKBELLY. SUMMER HERRING. Very close to the preceding, the body more elongate, the fins lower, the eyes smaller, the back darker. First ray of dorsal not equal to base of fin. Head 5; depth $3\frac{1}{2}$. With *P. pseudoharengus*, but running later, less abundant, and much less valuable as a food fish. (Lat., belonging to summer.)

aa. Gill rakers 20 to 25 on lower limb; peritoneum pale. (*Pomolobus*.)

c. Teeth in jaws all disappearing with age, a small patch sometimes remaining on tongue.

75. **P. mediocris** (Mitchill). TAILOR HERRING. FALL HERRING. MATTOWACCA. Head rather long, the profile straight and not very steep; form more elliptical than in the next and less heavy forward; opercles less emarginate below; fins low. Bluish above; sides with faint longitudinal streaks. Head 4; depth $3\frac{3}{8}$. D. 15; A. 21. Lat. l. 50. Ventral scutes 20 + 16. Gulf of Maine to Fla., chiefly S. Not highly valued. (Lat., mediocre.)

cc. Teeth on jaws usually persistent at tip of both jaws; peritoneum pale.

76. **P. chrysochloris** Rafinesque. SKIPJACK. OHIO HERRING. Body elliptical; head slender, rather pointed; lower jaw strongly projecting; maxillary reaching posterior part of eye; eye large, $4\frac{1}{3}$ in head; fins moderate; gill rakers not numerous, rather stout, about 23 on lower limb of arch; opercles striate. Bright blue; sides with golden reflections. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. 16; A. 18. Lat. l. 52. Scutes 20 + 13. L. 18. Miss. Valley, etc.; abundant and resident in larger streams, migrating from the Gulf of Mexico; introduced into the Great Lakes. A handsome but lean and poor fish in the rivers, becoming excessively fat in salt water. (Gr., *χρυσός*, golden; *χλωρός*, green.)

59. ALOSA (Linck) Cuvier (Lat., *alosa*, shad)

77. **A. sapidissima** (Wilson). AMERICAN SHAD. Body rather deep; mouth large; the jaws subequal, without teeth; gill rakers very long and slender, about 60 on lower part of arch; fins low. D. nearer snout than C. Bluish; sides more or less silvery; usually a dark blotch behind opercle and often several in a row behind this; peritoneum white. Head $4\frac{1}{3}$; depth $3\frac{1}{3}$. D. 15; A. 21. Scutes 21 + 16. Lat. l. 60. L. 30. Atl. coast, from the

Miramichi to the Carolinas ; ascending rivers to spawn. An excellent food fish ; introduced in California, etc. (Superlative of Lat., *sapidus*, good to eat.)

78. **A. ohiensis** Evermann. Ohio Shad. Gulf Shad. A small and slender species, the depth 4 in length. Gill rakers 70. D. 18; A. 18. Mississippi system, ascending streams to Louisville and Pittsburgh.

78 *a*. **A. alabamae** Jordan & Evermann. Alabama Shad. Smaller than the Northern shad ; short and chunky, the depth 3 in length ; gill rakers 40 ; maxillary narrow. Gulf coast ; ascending rivers to an unknown distance.

60. HARENGULA Cuvier & Valenciennes

(Low Lat., dim. of *harengus*, herring)

79. **H. macrophthalmus** (Ranzani). Sardina. Depth 3 to 3⅔. Gill rakers 29 to 33 on lower part of first arch. D. 16 to 19 ; A. 16 to 19. Scales firm, with crenate edges, but without prominent vertical striae. Silvery, with a dark humeral spot. Fla. to Brazil, rare N. to R. I. (Gr., μακρός, large ; ὀφθαλμός, eye.)

80. **H. maculosa** Cuvier & Valenciennes. Sardina. Depth 3 to 3½. Gill rakers 27 to 33 on lower part of first arch. D. 16 to 19 ; A. 16 to 19. Scales deciduous, without crenate edges, but with well-developed vertical striae. Silvery ; no black humeral spot ; tips of D. and A. dusky. L. 8. W. I., rare N. to Woods Hole, Mass. (Lat., spotted.)

61. SARDINELLA Cuv. & Val. (Low Lat., dim. of *Sardina*)

81. **S. aurita** Cuvier & Valenciennes. Smooth-cheeked Sardine. Body slender, little compressed ; belly scarcely carinated ; flesh soft and oily, as in the true sardines (*Sardina*) ; feeble teeth on lower jaw and tongue ; adipose eyelid well developed ; *cheeks* and *opercles without conspicuous striae*. Color plain blue, unspotted. Head 4 ; depth 4. D. 16 ; A. 16. Scales 45. Gill rakers numerous, 110 to 160. Vertebrae 45. W. I., in rather deep water ; ranging N. to Cape Cod and to coast of France. It is well distinguished from the true sardine (*Sardina* Antipa) by the absence of conspicuous striae on the opercle and by anatomical details. (Lat., eared.)

62. OPISTHONEMA Gill (Gr., ὄπισθε, behind ; νῆμα, thread)

82. **O. oglinum** (Le Sueur). Thread Herring. Body compressed ; belly strongly serrate ; jaws toothless ; dorsal filament about as long as head. Bluish, silvery below ; a bluish shoulder spot ; dark streaks along scales of back. Head 4 ; depth 3½. D. 19 ; A. 24. Lat. l. 50. Scutes 17 + 11. L. 12. W. I., rarely N. to Cape Cod. (Name unexplained, from *ogle*.)

63. BREVOORTIA Gill (To James Carson Brevoort)

83. **B. tyrannus** (Latrobe). Menhaden. Mossbunker. Pogy. Bugfish. Fatback. Body compressed, deep, heavy anteriorly ; no teeth ; gill rakers very long and slender ; scales very closely imbricated, irregularly

arranged; fins small. Bluish; sides silvery or brassy; fins yellowish; a dark scapular blotch, behind which are usually smaller spots. Head $3\frac{1}{3}$; depth 3. D. 19; A. 19. Lat. l. 60 to 80. Scutes 20 + 12. L. 20. Nova Scotia to Fla.; very abundant; herbivorous, spawning in the sea; used for oil and manure. A parasitic crustacean (*Oniscus praegustator*) is found in the mouth of this fish. The Roman *tyranni* had *praegustatores* to taste food in advance, thus forestalling attempts at poisoning.

84. **B. brevicaudata** (Goode). Opercles almost smooth; jaws and caudal fin short; body deeper. Atl. coast, rarely N. to Conn. (Lat., short-tailed.)

64. NEOSTEUS Norman (Gr., *νέος*, new; *ὀστέον*, bone)

85. **N. narragansetae** (Fowler). A small-toothed bone between premaxillary and maxillary; origin of D. in front of A.; A. 46; ventral scutes 25 + 7. Known only from R. I., but doubtless a straggler from the Tropics. (For the Narraganset Indians.)

Family XXXV. DOROSOMIDAE (The Gizzard Shads)

Body deep, compressed, covered with thin, deciduous scales; no lateral line; belly carinate, with sharp horny plates; head small, naked; mouth small, inferior, oblique, without teeth; maxillary narrow, with a single supplementary bone; gill membranes separate; an adipose eyelid; stomach short, muscular, like the gizzard of a fowl; fin small. Mud-eating fishes of large size, in estuaries of E. America and E. Asia; ascending streams; species few.

a. Dorsal fin with its last ray produced in a long filament; anal fin long, of about 30 rays. Dorosoma, 65.

65. DOROSOMA Rafinesque (Gr., *δόρυ*, lance; *σῶμα*, body)

86. **D. cepedianum** (Le Sueur). Gizzard Shad. Hickory Shad. Mud Shad. White-eyed Shad. Hairy Back. Body deep, compressed; scales thin, deciduous; head small; eye $4\frac{1}{2}$ in head; snout short, blunt; mandible enlarged at base; gill rakers very slender, not very long; an adipose eyelid; D. about median, its filament about as long as head; C. widely forked, its lower lobe longer; belly sharply serrate. Bluish; sides silvery; young with a round dark shoulder spot. Head $4\frac{1}{3}$; depth $2\frac{1}{3}$ (2 to 3). D. 12; A. 31. Lat. l. 56. Scutes 17 + 12. L. 15. Cape Cod to Mexico; abundant S., in most rivers; permanently resident throughout the Miss. Valley. A handsome, mud-loving fish, nearly worthless as food. (To Bernard Germain Etienne, Comte de La Cépède, afterwards "Citoyen Lacépède.")

Family XXXVI. ENGRAULIDAE (The Anchovies)

Body elongate, compressed, with thin, deciduous scales; mouth very large, the pointed, pig-like snout usually extending beyond it; maxillary very long

and slender, of about 3 pieces, extending backward usually far beyond the eye; premaxillaries small; teeth usually very small, canines sometimes present; eye large, well forward; gill rakers long and slender. B. 7 to 14; no lateral line; belly rounded or weakly serrate; no adipose fin; C. forked. Small fishes swimming in large schools, abundant in all warm seas; the American species, with belly entire, belonging largely to the somewhat degenerate genus *Anchoviella*, the Asiatic species, larger and with belly serrate, to *Stolephorus* and related genera. In temperate regions the number of vertebrae is increased, the species (none on our Atlantic coast) belonging to *Engraulis* Cuvier.

a. Belly without serrae. (*Engraulinae.*)
b. Vertebrae about 40; skeleton rather firm.
c. Gill membranes scarcely connected; gill openings very wide; no pectoral filaments; A. moderate, beginning behind D.; lower jaw included; maxillary not extending beyond gill opening; teeth very small; gill rakers 20 to 40, on lower limb of arch. ANCHOVIELLA, 66.

66. **ANCHOVIELLA** Fowler (SILVERY ANCHOVIES)

(Dim. of *Anchovia*, a related genus)

a. Body compressed, moderately elongate, the depth more than ⅓ the length; insertion of D. nearer C. than tip of snout.
b. Anal moderate, its rays about 26, its base 3⅔ in body.

87. **A. mitchilli** (Cuvier & Valenciennes). Snout rather blunt, little projecting; body much compressed; both jaws with teeth; eye very large. Pale, a narrow, diffuse, silvery lateral band, little broader than pupil. Head 3⅘; depth 4. D. 14; A. 26. Lat. l. 37. L. 2½. Maine to Texas; common S., on sandy shores; entering streams. (To Professor Samuel Latham Mitchill, of New York, an early ichthyologist.)

bb. Anal fin short, its rays about 20, its base 4⅔ in body.

88. **A. epsetus** (Bonnaterre). Snout pointed, considerably projecting; belly somewhat serrated; eye 3½ in head; teeth in both jaws. Translucent; silvery band sharply defined, about as broad as eye. Head 3¾; depth 4¾. D. 15; A. 20. Lat. l. 40. L. 6. Cape Cod to Brazil; exceedingly abundant S. (*Engraulis brownii* (Gmelin).) (*Hepsetus*, an old name for anchovies.)

aa. Body elongate, less compressed, the depth less than ⅓ the length; insertion of D. midway between snout and C.
c. Anal fin rather short, its rays about 19.

89. **A. argyrophana** (Cuvier & Valenciennes). Tail long and slender; snout pointed, projecting; belly not serrated; eye 4 in head; teeth in jaws present, feeble; anal short, its base 5½ in body. Silvery lateral band broad, diffuse, broader than eye. Head 3¾; depth 6. D. 14: A. 19. L. 4. Woods Hole, Mass., and S.; scarce. (*A. eurystole* Swain & Meek.) (Gr., ἄργυρος, silver; φαίνω, to show.)

cc. Anal fin very short, its rays 14 to 16.

90. **A. perfasciata** (Poey). Snout compressed and pointed, shorter than eye; eye $3\frac{1}{3}$; teeth in both jaws; maxillary not quite reaching preopercle. Lateral band well defined, $\frac{3}{4}$ as wide as eye. L. 2 to 3. N. Y. to Cuba, rare N. (Lat., well-banded.)

Family XXXVII. COREGONIDAE[1] (The Whitefishes)

Body oblong, covered with cycloid scales; head naked; mouth terminal or subinferior, of varying size; teeth small or wanting; maxillary broad, with supplemental bone, forming side of upper jaw; mouth not deeply cleft, the mandible articulating with the quadrate below or before the eye; scales rather large; anal fin rather long; pseudobranchiae present; no barbels; D. median; an adipose fin; C. forked; V. median; lateral line present; belly not compressed; vertebrae about 60. Stomach siphonal, with 15 to 200 pyloric caeca. Eggs large; no oviduct. Species numerous, all northern, chiefly lacustrine, spawning in lakes. All the species are highly valued as food fishes.

a. Jaws toothless or nearly so; scales large; maxillary short and broad, with a broad supplemental bone.
  b. Premaxillaries broad, with the cutting edge nearly vertical; lower jaw short, included; no teeth in jaws.
    c. Gill rakers short, thickish, 12 to 16 on lower limb; preorbital broad; supplemental maxillary narrow; body rather slender; a single flap between nostrils. (River fishes chiefly.) . . . . . Prosopium, 67.
    cc. Gill rakers long and slender, 17 to 20 on lower limb; preorbital long and narrow; supplemental maxillary ovate; body not elongate; a double flap between nostrils. (Lake fishes.) . . . . . Coregonus, 68.
  bb. Premaxillaries narrow, the cutting edge nearly horizontal and directed forward; lower jaw long, frequently projecting; mouth rather large; body more or less elongate, herring-shaped. (Lake fishes.) . . . . . Leucichthys, 69.

67. PROSOPIUM Milner (River Whitefish)

(Gr., *πρόσοπείον*, a small mask, from the broad preorbital)

91. **P. quadrilaterale** (Richardson). Round Whitefish. Menominee Whitefish. Shadwaiter. Body subterete, the back broad; head short, the snout compressed and bluntly pointed; mouth small; maxillary $4\frac{1}{2}$ in head; eye 5; snout $3\frac{1}{3}$; preorbital wider than pupil; adipose fin moderate. Dark olive; the sides paler. Head $5\frac{1}{3}$; depth $4\frac{1}{3}$. D. 11 to 13; A. 9 to 11. Scales 8–90–7. Gill rakers 6 + 10. Lakes and streams, from Me. to L. Superior and N.; locally common. (Lat., 4-sided.)

68. COREGONUS (Linnaeus) (Lake Whitefishes. Lavarets)

(An old name)

92. **C. clupeaformis** (Mitchill). Superior Whitefish. Sault Whitefish. "Whiting of Lake Winnepesaukee." Body subelliptical, robust, the

[1] For an illustrated review of American Coregonidae, see Jordan and Evermann, Bulletin Bureau of Fisheries, Vol. XXIX, for 1909 (1911).

shoulders elevated with age; head very small. Color pale, not silvery, with faint lengthwise streaks. Head 4 to 5; depth 3 to 4. D. 11; A. 11. Scales 8–85–9. Gill rakers 10 + 17. L. 30. Largest and most widely known of our species of Whitefish, abounding in lakes from Labrador through N. H. to W. N. Y. and the Great Lakes to Manitoba. It reaches 10 to 12 pounds ("Jumbo Whitefish"). It is one of the very best food fishes, and occasionally takes the hook (as about Sault Sainte Marie). It has received various scientific names, the earliest (scarcely appropriate) recalling its resemblance to the Shad. The form in Lake Erie has been called **C. albus** Le Sueur but shows no tangible differences. The "Otsego bass" of Otsego Lake (subsp. **otsego** Clinton) is one of many variants.

69. LEUCICHTHYS Dybowski (Lake Herrings. Ciscoes. Tullibees)
(*Argyrosomus* Agassiz, name preoccupied)
(Gr., λευκος, white; ἰχθύς, fish)

The species of this genus are closely related and easily modified by external conditions. Most of the nominal species in Siberia and northern Europe, as well as in the northern parts of America, will be reduced to the rank of subspecies when better known. As in some other flexible groups, individual variations are often more conspicuous than specific differences. The type of the genus *Leucichthys* (*L. omul*) has small teeth in the jaws, but none of the American species have teeth on the tongue at any stage.

As the various forms of this type have been developed relatively recently by processes connected with isolation, the application of the system of nomenclature must be essentially arbitrary, the distinctions between species and subspecies being very uncertain. Of the surface forms I regard five, *harengus*, *artedi*, *eriensis*, *tullibee*, and *nipigon*, as valid species, as well as some of the deep-water forms. But a very different list appears if we regard as subspecies all the variant descendants of the ancestors of *L. artedi*, species with the form and color of herrings, but with no special relationship.

a. Jaws without teeth (American species).
b. Adipose fin small, not larger than eye; form elongate, with short fins; the color metallic blue and silvery; depth about 4½ in length.

93. **L. harengus** (Richardson). Blue-back Herring. Georgian Bay Herring. Saginaw Herring. Body notably slender; caudal peduncle 3 in head; pectoral short, not reaching half way to ventrals; body lustrous blue above; back without lengthwise streaks; maxillary 3 in head. Head 4⅓; depth 4½ to 5. D. 11; A. 12. Scales 10–83–9, before dorsal 33. Gill rakers 16 + 31. L. Huron, L. Michigan, and L. Superior, chiefly inhabiting shallow bays; abundant. Slenderest of the Lake Herrings; known by its very small adipose fin. Represented in the western part of L. Superior by subspecies **arcturus** Jordan & Evermann, still slimmer; isolated from the rest of the species by the very deep water between Keweenaw Point and Isle Royal.

Only a straggler in Lake Erie. Found by the writer abundant in Saginaw Bay and Georgian Bay. (Low Lat., herring.) Another variant is supsp. **osmeriformis** (H. M. Smith), the LAKE SMELT. W. N. Y. Similar to typical *L. harengus* but with larger mouth, longer maxillary, more projecting lower jaw, larger eye, and longer head; eye 4 in head; maxillary $2\frac{3}{5}$ in head. Grayish above, silvery below; tips of D. and C. dark. Head 4; depth 5. D. 9; A. 13. Scales 9–83–10. Deep waters of Seneca and Skaneateles lakes, N. Y. (Lat., form of a smelt.)

94. **L. supernas** (Jordan & Evermann). CISCO OF LAKE SUPERIOR. Caudal peduncle stout, $2\frac{4}{5}$ on head; eye $4\frac{3}{5}$; snout 4; maxillary $2\frac{4}{5}$. Flesh soft and fat; skeleton feeble; mouth rather large; head broad; lower jaw projecting, with upward tip; head short and slender, $4\frac{1}{2}$ on length; depth 4; pectoral extending more than half way to ventrals; adipose fin small.

bb. Adipose fin large; body usually sub-elliptical.
c. Body relatively slender, the depth about 4 in length.
d. Gill rakers more than 40 in number. . . . . (*Thrissomimus* Gill.)
e. Species of rather large size, in shallow or surface waters, mostly spawning in the fall; gill rakers 39 to 45.

95. **L. artedi** (Le Sueur). LAKE HERRING. MICHIGAN HERRING. This species occurs throughout most of the Great Lakes region, including many of the smaller lakes as well as the Great Lakes proper. It is found in shallower water than any of the species except *L. harengus*, but sometimes lives in rather deep water. It breaks up into a number of local forms. As a whole this species can usually be distinguished by the rather large number of gill rakers (about 45 to 50), by the large adipose fin, and by the short fins, but none of the characters holds invariably. (To Peter Artedi of Sweden, the "Father of Ichthyology.")

In Lake Erie and elsewhere the typical *artedi* occurs. It is relatively stout; depth about 4; scales fewer than usual in *harengus*, usually about 75. The color is distinctly grayer than in *harengus*.

Similar forms occur in many inland lakes, as for instance those in Rawson and Howard lakes in Michigan which have been named as a distinct subspecies **bisselli** (Bollman). Another local form, subspecies **sisco** Jordan, was recognized in 1875, having been previously confounded with *L. harengus* and the nearer related *L. artedi* as the "sisco of Lake Tippecanoe." It was described from the glacial lake of that name and later from the similar Lake Geneva in Wisconsin. These lake forms, living in deep water and spawning near shore are smaller and paler and with softer flesh than are individuals of the lakes (since described as subspecies **huronius** Jordan and Evermann) but do not otherwise differ. They were evidently left behind in lakes in headwaters of the Wabash and Illinois rivers by the recession of Lake Michigan after the last glacial period. Another variant is the herring of Lake Ontario, noted below.

96. **L. ontariensis** Jordan & Evermann. ONTARIO HERRING. Body rather robust and compressed, the depth about 4 in length; caudal peduncle

stouter, about 2 in head ; pectoral reaching about half way to ventrals ; adipose fin larger than eye ; color bluish, the back slightly streaked. Maxillary 3 in head ; eye $4\frac{3}{4}$; snout 4. Paler than *L. artedi*. D. and C. dark-edged. Head $4\frac{1}{3}$; depth $3\frac{3}{4}$ to $4\frac{1}{3}$. Scales 9–76–8. Gill rakers 14 + 27. L. Ontario, the types from Desoronto, Canada.

ee. Species mostly small, living in moderate or great depths in the upper Great Lakes.
f. Gill rakers 38 to 45. . . . . (*Cisco* Jordan & Evermann.)

97. **L. reighardi** Koelz. Reighard Cisco. Body little compressed, more terete than in other ciscos ; head short ; snout short, truncate ; premaxillaries below level of pupil ; maxillary short, rimmed with black, $2\frac{2}{3}$ in head ; premaxillaries nearly vertical ; eye large, 4 in head ; lower jaw included ; fins edged with black ; pectoral reaching halfway to ventrals. Scales about 75. Gill rakers about 14 + 23. L. 8 to 10. A small pale species, like *L. hoyi* and *L. kiyi*. Upper Great Lakes, in depths not exceeding 60 fathoms. (Named for Dr. Jacob Reighard, of the University of Michigan.)

98. **L. hoyi** (Gill). Bloater. Body slender, compressed ; head moderate ; snout short, pointed ; premaxillaries nearly horizontal ; mandibles weak. Color bright silvery, jaws and edges of fins darker. Scales about 72. Gill rakers about 16 + 27. Great Lakes, in moderate depths, spawning in spring. One of the smallest of the ciscos ; used chiefly as bait for lake trout. (Named for Dr. Philo R. Hoy, of Racine, its discoverer.)

99. **L. alpenae** Koelz. Longjaw. Body elongate, fusiform ; head moderate ; snout broad and rounded ; maxillary reaching front of pupil ; mandible usually projecting. Fins pale, and partly becoming dark towards tip ; jaws pale ; head $4\frac{1}{3}$ in length ; depth 4. Scales about 80. Gill rakers about 14 + 25. Pectoral fins short, rarely reaching half way to ventrals. In length reaching 15 inches, and in weight 2 pounds. A fish of commercial importance. Lakes Huron and Michigan ; common at depths less than 60 fathoms, spawning in fall. (Named for Alpena on Lake Huron.)

100. **L. birgei** (Wagner). Cisco of Green Lake. Body slender ; premaxillaries forming a slight angle ; lower jaw included ; maxillaries not reaching center of eye ; dorsal large ; pectorals reaching more than halfway to ventrals ; adipose fin large ; eye 6 in head ; maxillary $2\frac{3}{5}$. Color pale ; upper fins dark-edged. Head $3\frac{9}{10}$; depth $3\frac{3}{4}$. Scales 70. Gill rakers 15 + 28. Green L., Wis. ; a landlocked deep-water form, allied to *L. zenithicus*. (Named for Dr. Edward A. Birge, president of the University of Wisconsin.)

101. **L. zenithicus** (Jordan & Evermann). Chub of Lake Superior. Body rather slender ; head large ; lower jaw the shorter ; mouth relatively large ; depth of caudal peduncle $3\frac{1}{2}$ in head ; eye $4\frac{3}{5}$; snout $3\frac{1}{2}$; maxillary $2\frac{3}{5}$. Color pale ; fins bluish, dusky at tips. Head 4 ; depth $4\frac{1}{2}$. D. 11 ; A. 12 ; Scales 8–80–3. Gill rakers 15 + 27. L. 12. Deep water of Lakes Superior, Huron, and Michigan. (Named for "the Zenith City of the Unsalted Seas.")

102. **L. kiyi** Koelz. KIYI. WATERBELLY. Body slender, but distinctly deepest in front of dorsal; head long and pointed; snout longer than eye, which is ¼ head; maxillary reaching front of pupil; mandible usually projecting; fins very long, especially the ventrals. Silvery with a greenish luster above; the back densely pigmented; head black above; the fins more or less blackish. Head 4, depth 4. Scales about 84. Gill rakers, in all, 34 to 42, spawning in fall and winter. All the Great Lakes except Erie; very abundant in deep water; one of the smallest of the ciscos. (A local name, probably Indian.)

ff. Gill rakers usually 39 to 50; habitat in deep water.

103. **L. nigripinnis** (Gill). BLACKFIN. Body robust, heaviest forward; mouth moderate, jaws about equal; depth of caudal peduncle 3; maxillary 2⅔. Color dark; fins all blackish. Head 4, depth about 4. D. 11; A. 12. Scales about 75. Gill rakers usually more than 45. Great Lakes, except Lake Erie; one of the largest of the ciscos; a fish of fair quality and of considerable commercial value, but now seriously depleted; often smoked for the trade. (Lat., black fin.)

104. **L. cyanopterus** (Jordan & Evermann). BLUE FIN. Color paler than *L. nigripinnis;* the dorsal and caudal bluish, becoming blackish only at tips. Head 4; depth 3¾; scales 75 to 80. Gill rakers 13 or 14 + 24 to 27, averaging 39. Western part of Lake Superior, in deep water. (Gr., κυανεός, blue; πτερόν, fin.)

105. **L. prognathus** (Smith). ONTARIO BLOATER. Body moderately elongate; head large, humped at nape; lower jaw prominent; eye 4; snout 4; maxillary 2½; head 4; depth 3½. D. 10; A. 11. Gill rakers, 16 to 29. Represents *L. nigricans* in deep waters of the western part of L. Ontario. Now nearly or quite exterminated. (Gr. προγναθός, projecting jaw.)

fff. Gill rakers usually fewer than 35; color very pale, even on jaws; spawns in summer (August).

106. **L. johannae** (Wagner). CHUB. Body subovate; jaws about even; eye 4½ in head; snout long and pointed; maxillary 2½. Head 4; depth 4. Scales 8–80 to 90–8. Gill rakers usually fewer than 33. Deep waters of Lakes Michigan and Huron. (To Mrs. Johanna Wagner.)

cc. Body deep, the depth 3 to 3⅓ in length of body.
g. General color pale, white, darker above; adipose fin very large.

107. **L. eriensis** (Jordan & Evermann). JUMBO HERRING. Body very robust, compressed; a marked cavity at occiput; caudal peduncle stout, 2⅕ in head; adipose fin unusually large, much larger than eye; mouth small, the lower jaw short; eye 5; snout 3¾; maxillary 3; pectoral not reaching half way to ventrals. Coloration pale. Head 4⅖; depth 3 to 3½; D. 10; A. 11. Scales 8–71–10, regular, firmly attached. Gill rakers 16 + 29. L. 16½. North shore of L. Erie, swimming in "middle water"; occasional in south

part of L. Huron; locally abundant. One of the finest of our food fishes, the flesh rich and of superior flavor, overlooked until recently but said to be rapidly increasing in abundance.

gg. General color very dark, scarcely or not silvery, caudal peduncle very short. (*Allosomus* Jordan.)

108. **L. tullibee** (Richardson). Tullibee. Tulipe. Body short and deep, elliptical; dorsal outline convex; ventral outline almost equally so; jaws subequal; maxillary reaching front of pupil; pectoral reaching much more than halfway to ventrals; fins rather large; eye in head 4; snout 4; maxillary 3; depth of caudal peduncle 2. Color dark olive; the ventral fins edged with dusky; sides white, not silvery. Head 4; depth 3. D. 12; A. 12. Scales 70. Gill rakers 16 + 34. Lakes of northwestern U. S. and Canada; abundant in Rainy L., L. of the Woods, and L. Winnipeg; specimens taken in L. Simcoe and others reported in Oneida L. Not valued as food. (An Indian name.)

Represented in Lake Huron by subspecies **manitoulinus** (Jordan & Evermann). Manitoulin Tullibee. Body more elongate than in *L. tullibee*; form symmetrical; jaws subequal; maxillary to front of pupil; pectoral reaching little more than half way to ventrals; fins rather large; eye $4\frac{1}{2}$ in head; snout 4; maxillary $2\frac{3}{4}$; depth of caudal peduncle $2\frac{1}{2}$. Color dark olive; the tips of ventral fins slightly darker. Head $3\frac{4}{5}$; depth $3\frac{2}{3}$. D. 12; A. 13. Scales 8–71–8. Gill rakers 16 + 29. North Channel of L. Huron about Grand Manitoulin I.; not known elsewhere; scarce.

bb. Gill rakers usually more than 54.

109. **L. nipigon** Koelz. Nipigon Tullibee. A very large species, very robust, and dark in color; in general appearance resembling *L. tullibee*, but distinguished from that and all other ciscos by the greatly increased number of gill rakers (55 to 60 in all). (Named for Lake Nipigon, where discovered.)

Family XXXVIII. SALMONIDAE (The Salmon and Trout)

Body elongate, moderately compressed, mouth large; jaws, palatines, and margin of tongue with strong teeth, maxillary forming margin of upper jaw. Scales always small; lateral line present; dorsal fins rather short, of 10 to 12 rays, anal with 9 to 16; caudal forked, emarginate, or truncate, the peduncle strong. Gills 4, a slit behind the 4th; gill rakers more or less elongate; ventrals inserted below the dorsal; pectorals placed low; adipose fin present; stomach siphonal, with very many pyloric caeca; eggs very large, falling into the cavity of the abdomen before exclusion, and hatching in cold or cooling water. In the Pacific Salmon (*Oncorhynchus* Suckley) but one set of reproductive cells is developed in the lifetime of the individual, which therefore dies after once spawning. Northern regions; 6 or 8 genera and many species,

those not anadromous split up into innumerable varieties, due to isolation under varying conditions. Salmon or Trout abound in all clear waters N. of lat. 40°. As game fishes, they stand supreme.

a. Species spawning more than once, not dying with the first reproductive act; tongue with teeth; anal short, with 8 to 10 developed rays.
b. Vomer flat, its toothed surface plane; the teeth on its shaft in 1 or 2 rows (sometimes lost with age); species black-spotted, with conspicuous scales.
c. Vomerine teeth little developed, those on the shaft few and often deciduous; scales large, about 120; sexual differences strong; breeding males with hooked upper jaw; vertebrae 63 to 70. (Salmon.) . . . . . SALMO, 70.
cc. Vomerine teeth numerous, persistent, in a long, double, or zigzag row; scales moderate or small, 115 to 200; vertebrae 58 to 62; sexual differences less marked. (Trout.) TRUTTA, 71.
bb. Vomer boat-shaped, the shaft strongly depressed, without teeth; scales very small, 200 or more, more or less imbedded; species with pale spots.
d. Vomer with a raised crest extending backward from the head, parallel with the shaft, this crest armed with strong teeth; hyoid bone with a broad band of strong teeth; spots gray, never red. (Lake Trout.) . . . . . CRISTIVOMER, 72.
dd. Vomer without raised crest, only its head toothed; hyoid bone with few teeth or none; red-spotted, the lower fins with bright edging. (Charrs or Brook Trout.) SALVELINUS, 73.

70. SALMO Linnaeus (SALMON)

(Low Lat., *salmo*, salmon — from *salio*, I leap)

110. **S. salar** Linnaeus. COMMON SALMON. ATLANTIC SALMON. Anadromous, with the vomerine teeth little developed, those on the shaft of the bone few and deciduous; C. deeply lunate, truncate in old age; no hyoid teeth; sexual differences very strong; breeding males with the lower jaw hooked upwards, the upper emarginate or perforate, to receive its tip; mouth moderate, maxillary reaching past eye, 2½ to 3 in head; preopercle with a distinct lower limb. Brownish above, the sides silvery; many black spots on head, body, and fins, these sometimes X-shaped; sides with red patches in males; young (parr, smolt) with dark crossbars and red spots. Head 4; depth 4. B. 11; D. 11; A. 9. Scales 23–120–21. Pyloric caeca 65. Vertebrae 63 to 70. Usual weight 15 pounds, but often much larger. N. Atl., S. to N. Y. and France; ascending all suitable rivers; often (subspecies **sebago** Girard) landlocked in lakes in Me. A similar landlocked form in Sweden. One of the best known and most valued of food fish. A smaller but very active variant is subspecies **ouananiche** M'Carthy, of the Saguenay region of Quebec. (Lat., *salar*, salmon.) One of the Pacific salmon, the Humpback, **Oncorhynchus gorbuscha** (Walbaum), has been introduced successfully to the coast of Maine and elsewhere east. It may be known by its generic traits, its very small scales, about 200, and by the oblong black spots on the caudal fin.

71. TRUTTA Linnaeus (BLACK-SPOTTED OR TRUE TROUT)

(Low Lat. for trout)

This group or genus, especially abundant in northern Europe, Siberia, Alaska, on our Pacific slope, and the Rocky Mountain region, has no represent-

atives east of the upper Missouri and the Rio Grande. Several species of *Trutta* have been introduced into the Great Lakes region and elsewhere east.

111. **T. trutta** (Linnaeus). Brown Trout. Ocellated red spots more or less well developed. Pectoral fins large. Adipose more or less orange, with faint spots or none. Scales 115 to 150. Introduced from Europe. The Loch Leven Trout, subspecies **levenensis**, with the red spots obsolescent, has been introduced but cannot be permanently distinguished from the typical *trutta*. (Low Lat., trout.)

112. **T. iridea** (Gibbons). Rainbow Trout. Steelhead Trout. Body more conspicuously spotted with black, but without red spots. Adipose definitely spotted or margined with black. Introduced from the West coast. The Shasta Rainbow (subspecies **shasta** Jordan) with 130 to 180 scales, is now being largely replaced in the East by the coastwise form (typical **iridea**), which has 115 to 140 scales. Sea-run examples are known as "Steelheads." (Lat., of the rainbow.)

113. **T. clarkii** (Richardson). Cutthroat Trout. Similar to *T. iridea*, but typically with a scarlet dash on each side of the throat, and with hyoid teeth (behind the lingual teeth). Scales 140 to 190. Introduced from the Western mountains, probably as more than one subspecies. (To William Clark, co-leader of the Lewis and Clark expedition to the Northwest.)

72. CRISTIVOMER Gill & Jordan (Great Lake Trout)

(Lat., *crista*, crest; vomer)

114. **C. namaycush** (Walbaum). Mackinaw Trout. Longe. Togue. Hyoid bone (base of tongue) with a band of strong teeth (besides the usual teeth around edge of tongue); head of the vomer with a raised crest, which projects backward, free from but parallel with the shaft, this crest with teeth; head very long; mouth very large, the maxillary reaching much beyond eye, 2 in head; eye large; teeth very strong; C. well forked. Dark gray, varying in shade; everywhere with round pale spots never red; head above, and D. and C. reticulate with darker. Head $4\frac{1}{4}$; depth 4. B. 12; D. 11; A. 11. Scales 185 to 205. L. 3 feet or more. Great Lakes region and smaller lakes from New Brunswick to Mont., Brit. Col., and Alaska; abundant, variable. A food fish of high value, reaching a weight of 80 pounds or more. In the western part of L. Superior is found the Siscowet (subspecies **siscowet** Agassiz), similar, but much plumper, living in deep water, where it feeds on schools of the fat Bluefin Cisco, *Leucichthys cyanopterus*. (An Indian name, as is also Siscowet.)

73. SALVELINUS (Nilsson) Richardson (Charrs)

(An old name, allied to the German *Saibling*)

The species of this group are in general smaller, finer, handsomer, and more wary than the true Trout, and they inhabit, in general, colder waters. Besides

the native species, attempts have been made to introduce the European charr, Saibling or Ombre Chevalier *Salvelinus alpinus* L., a species very close to *Salvelinus oquassa.*

a. Hyoid teeth none; head large, 4 to 4½ in length; red spots of body usually on sides only; back and dorsal fin much marbled with dark olive; spots sometimes gray.

115. **S. fontinalis** (Mitchill). Brook Trout. Speckled Trout. Head large, the snout bluntish; mouth large, the maxillary reaching beyond eye; eye large; C. lunate, forked in young. Dusky greenish; sides with red spots mostly smaller than pupil; back mostly unspotted, but conspicuously marbled or mottled with dark olive; D. and C. mottled or barred; lower fins dusky, with an orange band on first ray, followed by a darker one; belly mostly red in males. Head 4½; depth 4½. D. 10; A. 9. Scales 37–230–30. Gill rakers 6 + 11. L. 5 to 20. Greatest weight about 14 pounds. Our most esteemed fresh-water game fish, abounding in clear cold streams from Me. to the Dakotas and N. to Arctic Circle; S. in Mts. to Chattahoochee R. in N. Ga.; introduced into Cal. and Colo. Very variable. The sea-run race, **hudsonicus** (Suckley), from Gulf of St. Lawrence is silver-gray, and nearly plain, and reaches a large size; body more slender and thicker; spots orange rather than vermilion. Individuals from Dublin Pond, N. H. (subspecies **agassizii** Garman), are likewise pale, looking like Lake Trout. (Lat., living in fountains.)

bb. Hyoid teeth present, feeble, often lost; head smaller (about 5 in length); back not marbled.

c. Mouth small, the maxillary scarcely reaching past middle of eye. Vertebrae 59 to 62.

d. Gill rakers curled at the ends.

116. **S. aureolus** Bean. Sunapee Lake Trout. Maxillary reaching middle of eye, 2⅔ in head; eye a little longer than snout, 4⅔ in head; P. largest in ♂. Brilliantly colored, back brownish; sides silver-gray, with small orange spots above and below lateral line; C. grayish; belly orange; A. orange, edged before with white; V. orange, with white band across outer rays; no mottlings anywhere. Head 4⅕; depth 4⅕. D. 9; A. 8. Scales 35–210–40. L. 12 or more. Sunapee L., N. H., and other lakes in N. H. and Me. Equally near to *S. alpinus* L., the charr, of Europe. (Lat., gilded.)

dd. Gill rakers straight.

117. **S. oquassa** (Girard). Blueback Trout. Rangeley Lake Trout. Body elongate, compressed; head small, flattish above; eye 3⅓ in head; P. and V. not elongate; C. deeply lunate; opercles without striae. Dark blue, the red spots smaller than pupil, on sides only; traces of dark bars on sides; lower fins variegated as in other charrs, the tips pale. Head 5; depth 5. D. 10; A. 9. Lat. l. 230. Gill rakers 6 + 11. L. 12. Smallest and prettiest of our *Salmonidae* and most like the European *Salvelinus alpinus.* Found only in the Rangeley Lakes in S. W. Me. and (as *S. naresi* Günther) in some lakes in Arctic America. Perhaps a variety of *S. stagnalis* (Fabricius) of Greenland

and other northern forms, all much in need of comparative study. (From Oquassoc, one of the Rangeley Lakes.)

118. **S. marstoni** Garman. Lac de Marbre Trout. Slenderest of our charrs. Allied to *S. oquassa*, but with rather larger mouth, stronger teeth, fewer red spots. Head 5; depth 6. D. 13; A. 13. Gill rakers straight, 8 + 14. Vertebrae 65. Caudal rather deeply forked. Lac de Marbre, Quebec. (Named for R. B. Marston, of London, a well-known angler.)

c. Mouth very large, the maxillary reaching well beyond eye.

119. **S. timagamiensis** Henn & Rinkenbach. Mouth very large, the maxillary reaching much beyond eye; red spots very few and faint. Tributaries of Montreal R., Quebec. (A local name for the lake where originally taken.)

Family XXXIX. THYMALLIDAE (The Graylings)

Fishes resembling the *Salmonidae* in most regards, but with a longer dorsal fin, the anterior half of which is composed of simple unbranched rays; the skull materially different; the parietal bones meeting mesially, excluding the frontals from the occipital; epipleural spines on anterior ribs; teeth slender, sparse, none on tongue. The species are few, handsome, gamy fishes of the northern parts of Europe and America.

74. THYMALLUS Cuvier (Graylings)

(Gr., θυμάλλος, old name, the fish said to have the odor of thyme)

120. **T. tricolor** [1] Cope. Michigan Grayling. Body compressed, rather elongate; head short, subconic; mouth moderate, the maxillary to middle of eye; jaws subequal; teeth on tongue more or less lost with age; eye large, 3 in head; a bare space on breast; gill rakers slender, 11 below angle; D. long and high, especially in males, but lower than in the Alaska Grayling, *T. signifer* Richardson. Purplish gray, with small black spots; ventrals dusky, with pale lines; dorsal highly variegated, with crimson and dusky streaks and greenish and rose-colored spots. Head 5; depth 4⅔. D. 20; A. 10. Scales 8–93 to 100–9. L. 18. Streams of northern Mich., formerly taken in Jordan, Au Sable, and other rivers in the Lower Peninsula; still living in Otter River in the Upper Peninsula, but elsewhere extinct. Another glacial relic is the Montana Grayling (*T. montanus* Milner), abundant in certain headwaters of Missouri R., and now planted in some parts of the East. The American graylings have been set off from the European species as the subgenus *Thymalloides* Berg. Those who find *Thymallus* too near the earlier name *Thymalus*, a genus of beetles, may call this genus *Choregon* Minding. (Lat., *tris*, three; *color*, color).

[1] An earlier name, *Thymallus ontariensis* Cuv. & Val., was given to a grayling said to be from Milbert, who collected in New York. The streams of northern Michigan were then unexplored, and no grayling occurs about New York. It was probably a specimen from Lake Geneva, wrongly labeled.

Family XL. OSMERIDAE (The Smelts)

The smelts may be looked upon as reduced *Salmonidae*, the only important difference being in the form of the alimentary canal. The stomach is a blind sac, the esophagus and the pylorus opening close together, and the pyloric caeca are very few or wanting; jaws with sharp teeth. Chiefly small fishes, of the northern seas, most of them ascending streams or else casting spawn in the surf; the majority highly valued as food. All are silvery, and none have phosphorescent spots.

a. Mouth large; V. before middle of D.
  b. Scales very small, some of them modified in males; teeth feeble; P. large, of 16 to 20 rays; adipose fin with long base; anal rays 18. . . . . Mallotus, 75.
  bb. Scales moderate, all alike; teeth stronger, those on tongue enlarged; P. moderate, of about 12 rays; adipose fin short; anal rays 15. . . . . Osmerus, 76.

75. MALLOTUS Cuvier (Gr., μαλλωτός, villous)

121. **M. villosus** (Müller). Capelin. Lodde. Old males with scales above lateral line and on side of belly, elongate, closely imbricated, forming villous bands. Dusky; sides grayish. Head 4¼; depth 6. D. 12; A. 18. Scales 150. L. 12. Arctic, S. to Maine, W. to Brit. Col. and Kamchatka, spawning between tide marks; in enormous numbers N. They deposit in the sand their eggs, which are washed up on the beach and the beach becomes a quivering mass of eggs and sand. (Lat., hairy.)

76. OSMERUS (Artedi) Linnaeus (Gr., ὀσμηρός, odorous)

122. **O. mordax** (Mitchill). Smelt. Frostfish. Teeth strong, vomer with 2 to 4 fang-like teeth. Gill rakers shortish, ⅔ eye. Greenish; sides with a silvery band; back with dark points. Head 4; depth 6½. D. 10; A. 15. Scales 68. L. 12. Nova Scotia to Va.; entering rivers; sometimes landlocked, as in L. Memphremagog and lakes in Ontario. Represented S. of N. Y. by the species or subspecies **sargenti** Norris, with fewer gill rakers and higher anal. A variety called subspecies **spectrum** Cope slenderer, with very large eye, and small mouth, in Wilton Pond, Me. Subspecies **abbotti** Cope: stouter, with small eye and larger mouth; Cobessicontic Pond, Me.; also in Kennebec Co. (Lat., biting.)

Family XLI. ARGENTINIDAE (The Argentines)

Allied to the *Osmeridae*, but the mouth small, the jaws nearly or quite toothless; the scales large, with spinous edges; the short dorsal over the ventral; adipose fin present. Cold or deep waters N.; the species few.

77. ARGENTINA (Artedi) Linnaeus (Lat., *argentum*, silver)

123. **A. silus** Ascanius. Silvery. Head $4\frac{1}{6}$; depth $5\frac{1}{3}$. D. 12; A. 13. Scales 60 with spinous edges. Northern Eu.; rare S. to N. J. (Norwegian, *sild*, herring.)

NOTE. A large number of deep-sea fishes, more or less distantly related to the *Salmonidae*, occur in ocean depths. Those which belong to the *Isospondyli* may be known by the short premaxillaries, the maxillaries forming the whole margin of the upper jaw, a character which separates them from the *Iniomi*, another group, also largely of the deep seas, in which the margin of the upper jaw is wholly formed by the premaxillaries. Nearly all of both groups have an adipose fin, and very many of these, and especially of the *Iniomi*, have luminous glands on the head or sides of the body, these structures alike in both sexes.

SERIES APODES (EELS AND MORAYS)

Eel-like fishes; body elongate; no ventral fins; no true fin spines. Bones of head more or less abnormal.

ORDER XIII. ENCHELYCEPHALI (THE EELS)

Gill openings narrow, leading to large branchial slits; tongue present; opercle well developed; pectoral fins usually well developed. This group contains the great body of the eel-like fishes abundant in warm waters and in the deep seas. Scapular arch free from the cranium; no precoracoid arch; body much elongate, with many vertebrae; no ventral fins; maxillaries and premaxillaries united with other bones or else wanting; pharyngeal and opercular bones more or less deficient; no fin spines; no pseudobranchiae; scales minute or wanting. A large group, composed of degenerate *Physostomi*, its origin and relationship as yet, however, uncertain. Most of the Eels are tropical and marine, and many belong to the deep seas. Numerous genera and species not here included occur in the deep waters off our coast and in the West Indies. (Gr., ἔγχελυς, eel; κεφαλή, head.)

FAMILY XLII. ANGUILLIDAE (THE TRUE EELS)

Body compressed, covered with small, imbedded scales, linear in form, placed obliquely, some of them at right angles to others; lateral line present; head long; mouth large, the lower jaw projecting: teeth small, subequal, in bands on jaws and vomer; pterygoid bones slender; tongue free in front; nostrils lateral; lips full; opercles developed; vertical fins confluent; D. beginning well behind head; P. present; gill openings moderate. Eggs minute. Species numerous, closely related; crawling in the mud and ooze of brackish and fresh waters of most regions; absent on the Pacific coast of America. They are among the most voracious of fishes. "On their hunting excursions, they overturn alike huge and small stones, beneath which they

find species of shrimp and crayfish, of which they are excessively fond. Their noses are poked into every imaginable hole in their search for food, to the terror of innumerable small fishes." (*W. H. Ballou.*)

The eels often move for a considerable distance on land, in damp grass. High waterfalls (Cumberland Falls, for example), dams, and other obstructions are often passed in this way. It has been shown by Dr. Johs. Schmidt that both the European and American species spawn alike in the deep seas of the tropical Atlantic, northeast of the West Indies. It is thought that the female spawns once and then dies. The females are larger than the males, paler in color, with smaller eyes and higher fins.

78. ANGUILLA Thunberg (Lat., eel)

124. **A. bostoniensis**[1] Le Sueur. American Eel. Brown, more or less tinged with yellowish, especially below. Head $8\frac{1}{2}$. L. 40. N. Atl., from S. Greenland to Brazil; ascending all streams; found throughout Miss. Valley, never in the open sea, except when migrating for breeding. The American Eel has the distance from front of D. to front of A. a little less than head. In the European species (*A. anguilla* L.) this distance is a little greater, the D. being a little farther back. The American Eel has 105 vertebrae, the European about 115. (Lat., of Boston.)

Family XLIII. SIMENCHELYIDAE (The Pug-nosed Eels)

This family contains 2 species of rather large eels, but with the head strikingly different. Scales as in Anguilla; snout very blunt; mouth small, horizontal, transverse; jaws equal, each with a hard margin and with 2 rows of short blunt teeth; no teeth on vomer; lower jaw very strong; lips full; pectoral fins short. Species living in rather deep water; parasitic on the halibut, burrowing into its flesh.

79. SIMENCHELYS Gill (Gr., σιμός, pug-nosed; ἔγχελυς, eel)

125. **S. parasiticus** Gill. Pug-nosed Eel. Color plain brown. L. 2 feet. Newfoundland Banks to the Azores; scarce. (Lat., parasitic.)

Family XLIV. CONGRIDAE (The Conger Eels)

Eels distantly related to the *Anguillidae*, but without scales. D. commencing not far behind head. Species about 30, all strictly marine. *Leptocephalus morrisi* Gmelin, a translucent, ribbon-shaped creature, with very small head and no generative organs, is occasionally taken on our coasts. This is the larval stage in the development of the young of *Conger*.

[1] The name *bostoniensis* was preferred by Günther, the first reviser, to *rostrata*, which has line priority.

a. Jaws with an outer series of close-set teeth, forming a cutting edge; dorsal beginning behind root of pectorals. . . . . CONGER, 80.
aa. Teeth in jaws conical, not forming a cutting edge; dorsal beginning over the gill opening. ARIOSOMA, 81.

80. CONGER[1] Cuvier (Gr., γόγγρος, Conger, the ancient name.)

126. **C. conger** (Linnaeus). CONGER EEL. Lower jaw shorter than upper; cleft of mouth reaching beyond middle of the large eye. Dark brown above, paler below, D. and A. usually pale, with broad, black margin; P. dusky, pale-edged; pores of lateral line whitish; body sometimes wholly black. L. 6 feet. Open sea, N. to Cape Cod; common E. Many other Congers and related forms occur in deep seas and in the tropics. (*Eu.*)

81. ARIOSOMA Swainson (*Congermuraena* Kaup)

127. **A. balearicum** (De la Roche). Upper jaw but little projecting; lips thin. Tail a little longer than head and trunk, brownish or yellowish, silvery on sides and below; vertical fins with a narrow black edge. Tropics, N. to N. C. (*Eu.*) (Lat., from the Balearic Islands.)

FAMILY XLV. MYRIDAE (THE WORM EELS)

Eels of small size, plain colors and worm-like form.

82. MYROPHIS Lütken (*Myrus* + Gr., ὄφις, snake)

128. **M. punctatus** Lütken. WORM EEL. Pectorals small; vomer with teeth. Head 3; lower jaw included. Light brown, with dark brown dots. W. I., rarely N. to N. C. (Lat., spotted.)

FAMILY XLVI. OPHICHTHYIDAE (SNAKE EELS)

No scales. Tongue more or less adherent. Gill openings not united. Fleshy tip of tail projecting beyond end of D. and A.

a. Anal fin well developed; pectorals present.
b. Dorsal fin beginning before nape; pectorals small. . . . . BASCANICHTHYS, 83.
bb. Dorsal fin beginning behind gill opening; pectorals well developed. OPHICHTHUS, 84.
aa. Anal and pectoral fins absent. . . . . LETHARCHUS, 85.

83. BASCANICHTHYS Jordan & Davis

(Gr., βασκανός, malignant; ἰχθύς, fish)

129. **B. scuticaris** (Goode & Bean). BLACK-SNAKE EEL. Head about 9; snout 6 to 7; eye 2 in snout. Brown above, lighter below; front of

[1] In strictness, the name *Leptocephalus* should supersede *Conger*, being earlier, but there may be some doubt as to the identification of *L. morrisi*, and for the last hundred years *Leptocephalus* has been used as a general name for these peculiar immature forms. The International Commission on Zoölogical Nomenclature has lately validated the use of the name *Conger*.

head more or less mottled ; D. and A. fins pale. Fla. to N. C. (Lat., *scutica*, a whip.)

84. OPHICHTHUS Thunberg & Ahl (Gr., *ὄφις*, snake; *ἰχθύς*, fish)

130. **O. ocellatus** (Le Sueur). Spotted Snake Eel. Teeth biserial in both jaws ; uniserial on vomer ; anterior jaw teeth enlarged. Spots on body large and whitish. Dorsal beginning over or just before tip of P. N. C. to Brazil, rare on our coast. (Lat., eyed; i.e., eye-like spots.)

85. LETHARCHUS Goode & Bean

(Gr., *λήθος* forgetting; *ἀρχός*, anus, — for anal fin)

131. **L. velifer** Goode & Bean. Teeth uniserial on jaws and vomer, small; snout long and pointed, projecting $\frac{2}{3}$ its length beyond lower jaw. Gill openings almost horizontal. Plum-colored, D. white, broadly edged with black. N. C. to Fla. (Lat., *velum*, sail ; *fero*, I bear.)

Family XLVII. NEMICHTHYIDAE (The Snipe Eels)

Eels with the body excessively slender, almost whip-like, usually ending in a long filament; neck long and slender; jaws excessively long, the upper longer and recurved; teeth small, numerous, retrorse; no scales. Eels of the open sea, swimming near the surface.

a. Gill openings separate; vent at the throat. . . . . Nemichthys, 86.

86. NEMICHTHYS Richardson (Gr., *νῆμα*, thread; *ἰχθύς*, fish)

132. **N. scolopaceus** (Bonaparte). Snipe Eel. Pale above, blackish below. L. 36. Off Georges Banks of Cape Cod and Madeira. (Lat., *scolopax*, snipe.)

Order XIV. COLOCEPHALI (The Morays)

The Morays, without pectoral fins and with the bony skeleton more degenerate, are mostly confined to the tropics. The chief family is *Muraenidae*, and most of the many species belong to the genus *Gymnothorax* Bloch. (Gr., *κόλος*, defective; *κεφαλή*, head.)

Family XLVIII. MURAENIDAE (The Morays)

No pectorals. Skin thick, leathery, scaleless. Branchial openings small and round.

a. Vertical fins well developed. Dorsal inserted on head.
  b. Anterior but not posterior nostril with a tube.
    c. Teeth entire. . . . . Gymnothorax, 87.
    cc. Teeth serrate . . . . . Priodonophis, 88.
  bb. Both nostrils with tubes. . . . . Muraena, 89.

87. GYMNOTHORAX Bloch (Gr., γυμνός, naked; θώραξ, thorax)

133. **G. moringa** (Cuvier). Spotted Moray. Hamlet. Teeth uniserial, irregular. Yellowish, with large rounded, more or less confluent, dark spots. Dorsal without distinct dark margin. N. C. to Brazil, rare on our coast. (*Moringa*, Portuguese name.)

88. PRIODONOPHIS Kaup (Gr., πρίων, saw; ὀδούς, tooth; ὄφις, snake)

Teeth more or less serrate.

134. **P. ocellatus** (Agassiz). Yellow-spotted Moray. Brown, with irregular light yellowish spots irregularly placed; D. with large dark spots at its edge; A. black-edged. Mouth nearly closing. W. I., rare N. to N. J. (Lat., eyed.)

89. MURAENA (Artedi) Linnaeus (Gr., μύραινα, ancient name of *Muraena helena*)

135. **M. retifera** Goode & Bean. Reticulated Moray. Teeth all uniserial, large and strong in jaws; those in front not enlarged; vomerine teeth small, sharp. Jaws curved along the gape so that the mouth cannot be completely closed. Body covered with well-defined reticulations, inclosing light yellowish spots; gill openings largely black. N. C. and S. (Lat., *retus*, net; *fero*, I bear.)

Series OSTARIOPHYSI

(Fishes with the anterior vertebrae modified to connect with the air bladder inclosing an organ of hearing)

Besides the *Eventognathi* and *Nematognathi*, two other orders of *Ostariophysi* or *Plectospondyli* occur in tropical regions. These are the *Heterognathi* (Characins), the most primitive of all, in which the jaws, in most of the families, are provided with teeth, and the *Gymnonoti* (Carapos), in which the body is elongate, almost eel-like, and the teeth small.

Order XV. EVENTOGNATHI (The Carp, Dace, Minnows, and Loaches)

This enormous group contains the majority of the river fishes of the world. With the orders of *Heterognathi*, *Gymnonoti*, and *Nematognathi* it agrees in the peculiar character of the modification of the anterior vertebrae, which distinguishes these relatively recent forms from the older *Isospondyli*, with which they agree in most other traits of the *Physostomi*, soft-rayed or abdominal fishes. (Gr., εὖ, well; ἔνδος, within; γνάθος, jaw [from the large pharyngeal teeth].)

Family XLIX. CATOSTOMIDAE (The Suckers)

Body oblong, covered with cycloid scales; head naked; jaws toothless and without barbels, the maxillary forming a large part of the edge of the upper jaw; mouth usually protractile, the lips generally thick and fleshy; lower pharyngeal bones falciform, with many comb-like teeth in 1 row; branchiostegals 3; gill membranes united to isthmus; dorsal fin rather long, of 10 to 35 rays, without spine; anal short; caudal forked; ventrals abdominal, of about 10 rays; pectorals low; no adipose fin. Alimentary canal long, without caeca. Air bladder large, divided into 2 or 3 parts by transverse constrictions. Species about 60, inhabiting the rivers and lakes of North America; 2 species in Asia. The Suckers feed on plants and small animals; the flesh is rather tasteless and full of small bones. They ascend the rivers to spawn in spring, at which time the males have usually the A. and C., and often other parts of the body, covered with small, deciduous tubercles.

a. Dorsal fin elongate, its developed rays 20 to 35; air bladder in 2 parts.
  b. Fontanel entirely obliterated by union of the parietal bones; scales small (56); form elongate; head small; lips with several series of papillae. (*Cycleptinae.*)
    Cycleptus, 90.
  bb. Fontanel well developed; scales large (35 to 41). (*Ictiobinae.*)
    c. Anterior fontanel wanting, the frontals closely joined to the ethmoid; subopercle nearly semicircular; body robust. Coloration dark; pharyngeal teeth relatively strong; dorsal fin little elevated anteriorly.
      d. Mouth relatively large, terminal, very oblique, the upper lip on the level of the eye; maxillary shorter than snout; lips thin, nearly smooth . Megastomatobus, 91.
      dd. Mouth small, inferior, much below eye; maxillary as long as snout; lips more or less plicate. . . . . Ictiobus, 92.
    cc. Anterior fontanel well developed; cheek deep and long; subopercle subtriangular; dorsal fin more or less elevated anteriorly. Coloration pale. . Carpiodes, 93.
aa. Dorsal fin short, its rays 10 to 18. (*Catostominae.*)
  e. Air bladder normally in 2 parts; lower pharyngeals slender, with small teeth.
    f. Lips thick, papillose; lateral line complete; mouth small, inferior.
      g. Scales small (55 to 100), crowded anteriorly; interorbital region rounded.
        h. Jaws without hard sheaths; fontanel large. . . . . Catostomus, 94.
        hh. Jaws with hard squarish sheaths; fontanel small or wanting.
          Pantosteus, 95.
      gg. Scales larger (about 50), not crowded anteriorly; interorbital region more or less flat or concave; the frontal bone thick and broad.
        i. Head large, 4 to 4½ in length, with broad, concave, interorbital space.
          Hypentelium, 96.
        ii. Head very small, less depressed, the interorbital space flat, but not concave. . . . . Thoburnia, 97.
    ff. Lips thin, plicate; scales large (40 to 50).
      j. Lateral line wholly wanting, at all ages. . . . . Erimyzon, 98.
      jj. Lateral line imperfect in young, nearly complete in the adult. Minytrema, 99.
  ee. Air bladder in 3 parts; fontanel present; scales large (about 45); lateral line complete.
    k. Mouth normal, the upper jaw protractile; the lips more or less plicate.
      l. Lower pharyngeal bones moderate, the teeth compressed, gradually increasing in size downward.
        m. Species of large size, in rivers and lakes; the body robust; depth 3½ to 4; dorsal rays 12 to 15. (Red Horse.) . . . . . Moxostoma, 100.
        mm. Species of small size, in mountain brooks; depth 4 to 4½; dorsal rays 10 to 12; head short. (Jumprocks.) . . . . . Scartomyzon, 101.

ll. Lower pharyngeal bones very strong, with the lower teeth much enlarged, subcylindrical, and truncate; the upper teeth small and compressed.
PLACOPHARYNX, 102.

kk. Mouth singular, the upper lip not protractile, greatly enlarged; the lower split into 2 separate lobes; pharyngeal bones, etc., as in *Moxostoma*.
LAGOCHILA, 103.

90. CYCLEPTUS Rafinesque (Gr., κύκλος, round; λεπτός, slender; according to Rafinesque, small, round mouth)

136. **C. elongatus** (Le Sueur). BLACK HORSE. GOURD-SEED SUCKER. MISSOURI SUCKER. Head small, short and slender, rounded above; opercles small; eye small; fins large. Color blackish; ♂ in spring covered with small tubercles. Head 7; depth 4½. D. 30. Scales 9–56–7. L. 2½ feet. Miss. Valley; rather common in larger streams S., N. to Ohio. A remarkable fish, quite unlike others of the family. (Lat., elongate.)

91. MEGASTOMATOBUS Fowler (*Ichthyobus* Agassiz, not of Rafinesque) (Gr., μεγάς, large; στόμα, mouth; βοῦς, buffalo)

137. **M. cyprinella** (Cuvier & Valenciennes). RED-MOUTH BUFFALO. BIG-MOUTH BUFFALO. Body robust, the outline somewhat elliptical; head very large and thick; opercle coarsely striate, nearly half the length of head; lips scarcely plicate; pharyngeal teeth weak. Color dull brownish olive, not silvery; fins dusky. Head 3½; depth 3. D. 28; A. 9. Scales 7–37 to 41–6. L. 3 feet. Miss. Valley, N. to Winnipeg; common; reaches 20 to 50 pounds in weight. Not E. nor in the Great Lakes (except where recently introduced into Lake Erie). A coarse fish, not highly valued as food. (Lat., little carp.)

92. ICTIOBUS Rafinesque (*Bubalichthys* Agassiz) (SMALL-MOUTH BUFFALO FISH) (Gr., ἰχθύς, fish; βοῦς, buffalo)

138. **I. urus** (Agassiz). ROUND BUFFALO. BLACK BUFFALO. MONGREL BUFFALO. Body not much elevated, the back not keeled, the axis of the body not much farther from back than from line of belly; head thicker and blunter than in *I. bubalus;* eye smaller than in *I. bubalus;* lips thick and plicate, the folds broken up into papillae; longest dorsal rays scarcely half of base of fin; opercle coarsely striate. Color very dark; fins black. Head 3½ to 4; depth 3. D. 30. Scales 8–40–7. L. 3½ feet. Miss. Valley. Largest of the Buffalo fishes, but less common than the others; weight 20 to 50 pounds. (Lat., *urus*, wild bull.)

139. **I. bubalus** (Rafinesque). SMALL-MOUTH BUFFALO. RAZORBACK BUFFALO. Body considerably elevated, the back compressed; axis of body much nearer line of belly than back; head not very blunt, the mouth small and inferior; eye 4 to 5 in head; longest dorsal rays nearly half base of fin; pharyngeal teeth heavier and gill rakers shorter than in *M. cyprinella.* Color dusky, usually paler than the others; fins sometimes black. Head 4; depth 2⅔. D. 29.

Scales 8–39–6. L. 2½ feet. Miss. Valley, etc.; common. Rather smaller than the others, rarely exceeding 20 pounds. (Gr., βοῦβαλος, buffalo.)

93. CARPIODES Rafinesque (*Sclerognathus* Cuvier & Valenciennes) (Carp Suckers)

(Low Lat., *carpio*, carp; Gr., εἶδος, form.)

140. **C. carpio** (Rafinesque). River Carp. Back compressed, little arched; snout not blunt, projecting little beyond the mouth, its length a little more than that of eye; nostrils not close to tip of snout; opercle strongly striate; longest dorsal rays ⅔ to ⅘ length of base of fin, the anterior rays sometimes thickened, never filamentous; eye small, 4½ to 5 in head. Color dull silvery, sometimes brassy; some of the scales above often brownish at base. Head short, 4 in length; depth 3. D. 25 to 27. Scales 7–37–5. Ohio Valley to Texas; abundant. (*C. nummifer* Cope.) (Low Lat., carp.)

141. **C. difformis** Cope. Back elevated; snout very blunt, the maxillary reaching front of pupil; nostril very near end of snout and above or before upper lip; eyes large, 3½ to 4 in head; dorsal very high. Head 4; depth 2⅔. Ohio Valley and W. to Iowa and Okla.; common, especially in smaller streams. (Lat., deformed.)

142. **C. cyprinus** (Le Sueur). Quillback. Skimback. Snout subconic, projecting; anterior nostril distant from snout more than half an eye's diameter and considerably behind front of upper lip; maxillary reaching about to front of orbit; eye moderate or small, 4 to 5 in head; anterior rays of dorsal always elevated and filamentous in the adult, frequently as long as base of fin. Coloration usually pale. Head 3¾ to 4⅓; depth 2½ to 3. D. 26. Scales 7–37–5. Pa. to Va., and Canada to the Rio Grande; abundant. (Lat., carp.)

94. CATOSTOMUS Le Sueur (Fine-scaled Suckers)

(Gr., κάτω, inferior; στόμα, mouth)

a. Scales very small, much reduced and crowded anteriorly, about 100 in the lateral line. (*Catostomus.*)

143. **C. catostomus** (Forster). Northern Sucker. Upper lip thin, with 2 to 4 rows of papillae; snout long, overhanging the large mouth. Males in spring profusely tuberculate and with a broad rosy lateral band. Great Lakes to Alaska; very abundant N.

aa. Scales larger, but small and crowded forwards, about 70 in the lateral line. (*Decactylus* Rafinesque.)

144. **C. commersonnii** (Lacépède). Common Sucker. White Sucker. Upper lip thin, with 2 or 3 rows of papillae; snout shorter than in the preceding, the mouth smaller. Color olivaceous, dusky above; sides rosy in spring. Head 4¼; depth 4¼. D. 12. Scales 10–55 to 70–9. L. 18. Can. to Mont.

and Fla.; commonest of the Suckers; extremely variable. Represented in the streams of the Great Plains by subspecies **sucklii** Girard, with more papillose lips. (Named for Philibert Commerson, a noted collector of fishes, but who never saw the species.) (*C. teres* Mitchill.)

95. PANTOSTEUS Cope (Mountain Suckers)

(Gr., πᾶν, all; ὀστέον, bone)

145. **P. jordani** Evermann. Fontanel small, persisting in adult. Lips very full. Scales fine, 90 to 100. Dark greenish, finely speckled, the males with an orange lateral band. Rocky Mts., and E. to Nebr. and S. D. (To David Starr Jordan.)

96. HYPENTELIUM Rafinesque (Gr., ὑπό, below; πέντε, five; Lat., *labium*, lip)

146. **H. nigricans** (Le Sueur). Hog Sucker. Stone Lugger. Stone Toter. Hammerhead. Crawl-a-Bottom. Hog Mullet. Head flattened above, concave between eyes; the frontal bone thick, broad and short; eyes small, placed high; upper lip thick, with 8 to 10 rows of papillae; lower fins large. Color brassy-olive, the back with dark cross-blotches; lower fins somewhat reddish. Head 4; depth 4¾. D. 11. Lat. 1. 48 to 55. L. 1½ feet. Lakes and clear streams, W. N. Y. to Ala. and Kans.; common; a striking fish which lies mostly on the bottom of clear streams. (Lat., blackish.)

97. THOBURNIA Jordan & Snyder

(Named for Dr. Wilbur Wilson Thoburn, of Stanford University)

147. **T. rhothoeca** (Thoburn). Allied to *H. nigricans*, but with much smaller head, not concave above. Dark olive, a black lateral stripe and dark crossbars. Head 5; depth 5. D. 11; A. 8 or 9. Scales 7–48–5. L. 5. Atlantic drainage of Va. (Gr., ῥόθος, torrent; οἰκέω, to inhabit.)

98. ERIMYZON Jordan

(Gr., ἐρι, an intensive particle; μύζω, to suck; μυζών, used for sucker)

148. **E. sucetta oblongus** (Mitchill). Chub Sucker. Sweet Sucker. Creek-fish. Scales crowded, deeper than long; mandible oblique. Color dusky, brassy below; young with black bands; older fish either barred or banded. Head 4; depth 3¼ in adult; D. 11 to 13. Scales 43–15. Sexes unlike, the male in spring with 4 large tubercles on snout. Great Lakes to Okla. and E.; very abundant. Represented S. by the typical subspecies **E. s. sucetta** (Lacépède); deeper and more compressed; scales 36–15; Va. to the Rio Grande. (Lat., oblong.)

99. **MINYTREMA** Jordan

(Gr., *μινύς*, lessened; *τρῆμα*, aperture; from the imperfect lateral line)

149. **M. melanops** Rafinesque. Striped Sucker. Winter Sucker. Body subterete, little compressed; mouth small, inferior; eye small; scales little crowded forwards. Color dusky; coppery below, a dusky blotch behind dorsal; each scale with a dark spot at its base, most distinct in adult, these forming longitudinal stripes. ♂ tuberculate in spring; lateral line wanting in young, imperfect at 8 inches, nearly complete in adults. Head $4\frac{1}{3}$; depth 3 to $4\frac{1}{2}$. D. 12 to 14. Scales 46–13. L. 15. Great Lakes to Fla. and Texas; common. (Gr., *μέλας*, black; *ὤψ*, appearance.)

100. **MOXOSTOMA** Rafinesque (Red Horse)

(Gr., *μύζω*, to suck; *στόμα*, mouth)

b. Lips granular, not plicate.

150. **M. papillosum** (Cope). White Mullet. Back not elevated; lower lip V-shaped. Top of head white, silvery; back dusky-shaded; fins pale. Head 4; depth $4\frac{1}{2}$. D. 12. Scales 6–42–5. Dismal Swamp and S.; abundant in N. C., where a number of other species of this genus occur also. (Lat., papillose.)

bb. Lips distinctly plicate.

c. Dorsal large, with 15 to 18 developed rays, its free edge not concave.

151. **M. anisurum** (Rafinesque). White Nose. Red Horse. Body robust, compressed; mouth large, inferior, the upper lip thin, the lower strongly ∧-shaped, finely papillose; D. high and large, the first ray about as long as fin; upper lobe of C. narrow, longer than lower. Color pale; C. smoky-gray; lower fins barely red. Head 4; depth $3\frac{1}{2}$. D. 15 to 18. L. 18. Ohio R. and Great Lakes, and N. to Montreal and Winnipeg. (*Catostomus carpio* Cuvier & Valenciennes, not of Rafinesque; *Moxostoma valenciennesi* Jordan; *Ptychostomus velatus* Cope.) (Gr., *ἄνισος*, unequal; *οὐρά*, tail.)

152. **M. collapsum** (Cope). Small-mouthed Red Horse. Close to *M. anisurum*, but the mouth smaller; caudal lobes subequal. Silvery, without dark spots above; lower fins red. Head 4; depth $3\frac{1}{3}$. D. 15. Scales 6–42–5. Lowland streams; Roanoke R. and S.; abundant. (Lat., compressed.)

cc. Dorsal fin moderate, of 12 to 14 rays; lower lip full, scarcely ∧-shaped, nearly truncate behind.

d. Dorsal fin with its free margin nearly straight.

153. **M. macrolepidotum** (Le Sueur). Eastern Red Horse. White Sucker. Head broad, flattish above; mouth large, with thick lips; depth of cheek usually more than half distance from snout to preopercle; eye large; edge of D. nearly straight, its first ray shorter than head; C. lobes subequal. Olivaceous, with bright reflections; sides silvery; lower fins always orange-

red, C. sometimes so. Head 4 to nearly 5; depth 3½. D. usually 13; A. 7. Scales as in other species, 5–45–4. L. 2 feet. Chesapeake region (very abundant) and S., E. of the mountains. (Gr., *μαχρός*, large; *λεπιδοτός*, scaled.)

154. **M. aureolum** (Le Sueur). Common Red Horse. Mouth rather small, with thick lips; snout bluntish; eye moderate; C. lobes subequal; D. rather low, its longest ray less than base of fin. Coloration of preceding. Caudal as well as lower fins always red. D. 13; depth 3½. Scales 45. S. Canada, Great Lakes and Miss. Valley, S. to Ala. and Ark.; abundant N. (Lat., gilded.)

155. **M. duquesnii** Le Sueur. Allegheny Red Horse. Scales about 47. Allegheny Mts., W. to Mich. and Okla. (*M. alleghaniensis* Nichols.) (For Fort Duquesne, now Pittsburgh.)

dd. Dorsal falcate, the free margin deeply incised.

156. **M. lesueurii** (Richardson). Body deep, compressed, with very small mouth overhung by the small snout; upper lobe of C. longer; dorsal deeply incised; A. long. Head 5; depth 3⅓ to 4. D. 13. Scales 6–45–5. Ohio Valley and Great Lakes and N.; abundant in L. Erie. (To Charles Alexandre Le Sueur.)

157. **M. crassilabre** (Cope). Golden Mullet. Form of a *Coregonus*, with deep, compressed body, small head, and short snout which overhangs the moderate mouth; eye small, 5 in head; D. high, the anterior rays 1⅓ to 1½ times base of fin; free margin of fin concave, so that the fin is decidedly falcate; C. lobes equal; A. large, falcate, reaching beyond front of C. Color yellowish, pale; D. and C. bright red; base of scales each with a dark spot. Head 5 to 5¼; depth 3¼ to 3½. Scales 45. Neuse R., N. C., and S. (Lat., *crassus*, thick; *labrum*, lip.)

Note. Several other species of *Moxostoma* have been described from North Carolina, but they have never been critically studied.

101. SCARTOMYZON Fowler (Gr., *σκάρτης*, leaper)

158. **S. cervinus** (Cope). Jumprocks. Jumping Mullet. Head very short, rather pointed; mouth rather large, the lips strongly plicate; eye small; fins all small; free edge of dorsal straight, its longest ray less than head. Color greenish brown, a pale blotch on each scale, these forming continuous streaks; back with brownish blotches; fins brownish, scarcely red. Head 5; depth 4. D. 11. Scales 6–44 to 49–5. L. 10. Va., S. to Neuse R.; not rare in swift streams. (Lat., tawny, like a deer.)

159. **S. rupiscartes** (Jordan & Jenkins). Body long and low; head very short; lips full. Olive-brown; young with pale streaks. Head 4⅘; depth 5¾. D. 11; A. 8. Scales 6–50–6. L. 12. Rivers S. of Va., about rapids, replacing *S. cervinus* S. (Lat., *rupis*, rock; Gr., *σκάρτης*, leaper.)

102. PLACOPHARYNX Cope

(Gr., πλάξ, a broad surface; φάρυγξ, pharynx)

160. **P. carinatus** Cope. A large, coarse sucker, externally similar to the species of *Moxostoma*, from which genus it differs only in the remarkable development of the lower pharyngeals and their teeth; the bones are very strong, and 6 to 10 of the lower teeth are enlarged, little compressed, with a broad rounded or flattened grinding surface; the mouth is larger and more oblique than in *M. macrolepidotum* and the lips are thicker. Head broad and flattish above, its upper surface somewhat uneven; longest rays of dorsal longer than base of fin, $1\frac{1}{8}$ in head; free edge of D. concave; upper lobe of C. narrower than lower and more or less longer. Color dark olive-green; sides brassy; no silvery luster; C. and lower fins orange-red. Head 4; depth $3\frac{2}{3}$. D. 12. Scales 6–45–5. L. 30. S. Mich. to Ga. and Ark.; abundant in larger streams. (Lat., keeled.)

103. LAGOCHILA Jordan & Brayton

(*Quassilabia* Jordan & Brayton, *Lagochila* being set aside, on account of its similarity to *Lagocheilus*, an earlier name)

(Gr., λαγώς, hare; χείλος, lip)

161. **L. lacera** Jordan & Brayton. Harelip Sucker. Rabbitmouth Sucker. Pea-lip Sucker. Cutlips. Splitmouth. Upper lip plicate, much prolonged; lower reduced to 2 separate, elongate, papillose lobes, the split between them reaching the dentary bones, which have a horny sheath; lower lip separated from upper by a deep fissure at angle; skin of cheeks sheathing this fissure; body rather slender, much as in *Scartomyzon;* opercle small; head very small, conical; dorsal low. Color pale; lower fins slightly reddish. Head 5; depth $4\frac{2}{3}$. D. 12. Scales 5–45–5. L. 18. Maumee R., Ind., to Chickamauga R., Ga. and White R., Ark.; common in the Ozark Mts.; a singular fish. (Lat., torn.)

Family L. CYPRINIDAE (The Carp, Dace, and Minnows)

Head naked, body usually scaly; margin of upper jaw formed by premaxillaries only; mouth toothless; barbels 2 to 4 (absent in most of our genera and not large in any); lower pharyngeal bones well developed, falciform, nearly parallel with the gill arches, each provided with 1 to 3 series of teeth in small number, rarely more than 7 on each side (4 or 5 in the main row in our species); belly usually rounded, rarely compressed, never serrated; gill openings moderate, the membranes joined to the isthmus; no adipose fin; dorsal fin (in American species) short, with fewer than 10 rays; air bladder usually large, commonly divided into an anterior and a posterior lobe, rarely wanting; stomach without appendages, appearing as a simple enlargement of the intestines.

Fishes of moderate or small size, inhabiting the fresh waters of Europe, Asia,

Africa, and North America. Species upwards of 1000; excessively abundant where found, both in individuals and in kinds, and from their great uniformity in size, form, and coloration constituting one of the most difficult groups in zoölogy in which to distinguish species. Ours are mostly of smaller size than those of the Old World and with fewer teeth. Our largest Eastern species, *Leucosomus bullaris*, rarely attains a weight of 3 or 4 pounds and a length of nearly 18 inches. The smallest species of *Notropis* scarcely reaches a length of 2 inches.

The spring or breeding dress of the male fishes is often peculiar. The top of the head, and often the fins, snout, or other portions of the body, are covered with small tubercles, outgrowths from the epidermis. The fins and other parts are often charged with pigment, the usual color being red, but sometimes satin-white, yellowish, or black.

Young *Cyprinidae* are usually more slender than adults of the same species, and the eye is always much larger; they also frequently show a dark lateral stripe and caudal spot, which the adults may not possess. In the following descriptions the rudimentary rays of dorsal and anal are not counted. The fins and scales are often, especially in individuals living in small brooks, covered with round black specks, of parasitic origin. These should not be mistaken for true color markings.

No progress can be made in the study of these fishes without careful attention to the teeth, as the genera are largely based on dental characters. The pharyngeal bones in the smaller species can be removed by inserting a fine scalpel, operated through the gill opening, under the shoulder girdle. The teeth should be carefully cleaned with a sharp dissecting needle, and may then be examined by any small lens. In most cases a principal row of 4 or 5 larger teeth will be found, in front of which is a set of 1 or 2 smaller ones. The two sides are usually, but not always, symmetrical. Thus, "teeth 2, 4–5, 1" indicates 2 rows of teeth on each side, on the one side 4 in the principal row and 2 in the lesser, on the other side 5 in the main row and 1 in the other. "Teeth 4–4" indicates a single row of 4 on each pharyngeal bone, and so on.

In the *Leuciscine* genera, these teeth, or the principal ones, are "raptorial"; that is, hooked inward at the tips. A *grinding* or *masticatory* surface is an excavated space or groove, usually at the base of the hook. Sometimes the grinding surface is very narrow and confined to 1 or 2 teeth. Sometimes a beveled or flattened edge looks so much like a grinding surface that it misleads a superficial observer. In some cases the edge of the tooth is crenate or serrate.

Besides the native species here mentioned, representatives of two other genera have been introduced from Europe and have become inhabitants of some Eastern streams. These are *Cyprinus* Linnaeus and *Carassius* Nilsson. The first is distinguished by the very long dorsal, which, like the anal, is preceded by a strong spine, serrated behind. About the mouth are 4 long barbels, and the teeth are molar, 1, 3–3, 1. This genus is represented by the Carp (**Cyprinus carpio** Linnaeus). The Carp is normally covered with large scales. In domestication, however, variations have arisen, prominent ones being the "Leather Carp," naked, and the "Mirror Carp," with a few series of very large scales. Japanese breeders have developed red and mottled forms of carp with the goldfish.

Carassius Nilsson differs from *Cyprinus* chiefly in the absence of barbels and in having the teeth compressed, 4–4. The Goldfish (**Carassius auratus** Linnaeus) is originally olivaceous, but chiefly the orange-red varieties are valued for aquaria. Both *Carassius* and *Cyprinus* are native in China.

A few other European cyprinids, the tench, **Tinca tinca** (Linnaeus); ide, **Idus idus** (Linnaeus); the bitterling, **Rhodeus amarus** (Bloch), and the pearl roach, **Scardineus erythrophthalmus** (Linnaeus), have been introduced into our waters, but have not yet become widely established.

We begin the series with the genera most nearly allied to the European forms, from which most of ours may be supposed to have originated, continuing with the more or less degenerate allies of *Nocomis* and *Notropis*, the series closing with aberrant and specialized allies of these.

A. Air bladder wholly above (dorsal) the alimentary canal (not surrounded by many convolutions of the intestines).
B. Pharyngeal teeth in the main row 5–5 or 4–5 (seldom 4 on both sides).
C. Alimentary canal moderate, about twice length of body; teeth 1-rowed, the grinding surface well developed, the hook slight; upper jaw protractile; anal fin short; scales very small; dorsal inserted behind ventrals; peritoneum black; herbivorous. (*Chrosominae.*)
D. Lips thin, normal; lateral line incomplete; body plump; pseudobranchiae present. . . . . CHROSOMUS, 104.
CC. Alimentary canal short, less than twice length of body; teeth hooked, the grinding surface narrow or rudimentary; peritoneum mostly pale; carnivorous. (*Leuciscinae.*)
E. Maxillary never with a barbel; premaxillaries protractile.
F. Anal basis long (rays 10 to 18); abdomen compressed to an edge, the scales not crossing it.
G. Teeth 5–5, with grinding surface and serrate edges; gill rakers long; dorsal inserted behind ventrals. . . . . NOTEMIGONUS, 105.
FF. Anal basis short (rays usually 8 to 10).
H. Teeth 1-rowed, 5–5, serrate; mouth very small; D. over V.
§ Mouth nearly vertical, terminal. . . . . OPSOPOEODUS, 106.
§§ Mouth nearly horizontal, subinferior . . . . . OPSOPOEA, 107.
HH. Teeth 2-rowed, 2, 4–5, 2, or 2, 4–4, 2; male with much red in spring.
I. Lateral line complete in the adult; mouth very wide, the lower jaw projecting; upper lip on level of middle of pupil; body elongate, compressed; dorsal inserted well behind ventrals. . . . . CLINOSTOMUS, 108.
II. Lateral line more or less incomplete.
J. Scales minute, 80 to 100 in a series; lateral line very short; snout blunt; body plump. . . . . PFRILLE, 109.
JJ. Scales rather large; lateral line better developed, often nearly complete.
K. Scales about 43; snout not very blunt. . . . . HEMITREMIA, 110.
KK. Scales about 55; snout blunt; barbel normally present, but often obsolete. . . . . MARGARISCUS, 111.
KKK. Scales 45 to 55; snout moderate; barbel seldom wanting (young of *Semotilus* and *Leucosomus*).
EE. Maxillary with a small barbel placed above its tip; premaxillaries protractile; teeth 2, 4–5, 2, without grinding surface; caudal fin symmetrical.
L. Scales not crowded anteriorly; dorsal without black spot at base in front.
M. Dorsal fin inserted well behind ventrals; head large, rounded; mouth small, terminal, oblique; lateral line more or less incomplete; barbel very small, often wanting; scales 55 to 75. . . . . MARGARISCUS, 111.
MM. Dorsal inserted nearly over ventrals; mouth rather large, terminal; lateral line complete; scales 45. . . . . LEUCOSOMUS, 112.
LL. Scales much crowded anteriorly, about 55; dorsal inserted well behind ventrals; lateral line complete; a black spot at base of dorsal in front. SEMOTILUS, 113.
BB. Pharyngeal teeth in the main row, almost always 4–4.
N. Maxillary with a small barbel near its tip (rarely obsolete). (*Gobioninae.*)
O. Alimentary canal short, rarely more than twice length of body.
P. Premaxillaries not protractile; teeth 2, 4–4, 2; dorsal behind ventrals; scales very small. . . . . RHINICHTHYS, 114.
PP. Premaxillaries protractile.

Q. Species generally of moderate or small size, the mouth inferior, horizontal; preorbital broad, silvery; sexes not very different, the head in the male often tuberculate, the fins rosy.

R. Teeth 1-rowed, 4–4.

S. Barbels 2 on each side; body long and low. EXTRARIUS (in part), 115.

SS. Barbel single on each side.

T. Teeth without grinding surface.

U. Scales large, 37; body very long and low, with the aspect of the European gudgeon (*Gobio*); snout projecting; dorsal fin plain.

§ Scales without a longitudinal keel; eye moderate. EXTRARIUS (in part), 115.

§§ Scales each with a longitudinal keel; eye very small. MACRHYBOPSIS, 116.

UU. Scales smaller (about 56); dorsal fin with a large black blotch. ERIMONAX, 117.

TT. Teeth with a narrow grinding surface; scales moderate (44 to 50). ERIMYSTAX, 118.

RR. Teeth 2-rowed, 1, 4–4, 1 or 0, without grinding surface; mouth small, below the blunt snout; scales large (34 to 40); silvery species with broad preorbital. . . . . ERINEMUS, 119.

RRR. Teeth, 2, 4–4, 2 or 1.

W. Head transversely convex above; teeth without grinding surface. COUESIUS, 121.

WW. Head flattened above; teeth with grinding surface; scales large. PLATYGOBIO, 122.

QQ. Species of large size, not silvery; mouth large, nearly terminal; scales moderate (40); dorsal slightly behind ventrals; eye small; aspect of *Semotilus*. . . . . NOCOMIS, 120.

NN. Maxillary without barbel; premaxillary protractile.

X. Alimentary canal short, less than twice length of body; teeth hooked, with little or no grinding surface; peritoneum generally pale; species carnivorous.

Y. Dentary bones broadly arched, as usual among fishes. (*Notropinae.*)

a. Mandible, interopercle and suborbital, not evidently cavernous.

b. Lower lip thin or obsolete (except in one or two species), not developed as a fleshy lobe on each side.[1]

c. First (rudimentary) ray of D. small, closely joined to the first developed ray, as usual in this family.

d. Teeth in one or two rows; four in the main row; one or none at all in the short row on one side or both; often 2 on both sides in *H. hudsonius;* anal rays 7 to 9.

e. Scales not closely imbricated; not deeper than long; scales 32 to 39; scales before dorsal large, usually about 15; dorsal inserted nearly above ventrals; small, weak fishes with the mouth small, the body oblong, not greatly compressed. Body and fins with little red; grinding surface of teeth well developed; anal rays 7 or 8; lateral line complete or incomplete (*Chriope*). . . . . HYBOPSIS, 123.

ee. Scales closely imbricated, more or less deeper than long especially in the adult; scales moderate, 31 to 44, those before dorsal 15 to 20; dorsal inserted usually behind ventrals; grinding surfaceof teeth narrow or obsolete, sometimes serrate; male in spring usually with much pigment, the dorsal fin often tipped with silvery white; a large black blotch on its upper rays in adult present (*Eogala*) or absent (*Cyprinella*). . . . . CYPRINELLA, 124.

dd. Teeth regularly 2, 4–4, 2; lesser row rarely with 1 only on one side (2, 4–4, 1)

f. Teeth with well-developed grinding surface. No dorsal spot.

h. Size large, adult 5 to 8 inches; scales large, about 40; males with much red pigment; usually no black spot on front base of dorsal. . . LUXILUS, 125.

g. Scales moderate, 38 to 42, not closely imbricated; size rather small; anal rays mostly 8; males with much pigment; laws equal (*Hydrophlox*) or the lower projecting (*Coccotis*). . . . . HYDROPHLOX, 126.

[1] The genera which immediately follow, allies of *Hybopsis*, and *Notropis*, are fishes largely of feeble organization and their characters are ill defined. I prefer to recognize them, as they represent different lines of evolution.

hh. Size small, length two to four inches; anal rays 9 to 12.

i. Scales moderate, about 45 to 50.

j. Scales rather closely imbricated, those before dorsal smaller; dorsal inserted behind ventrals; males with much red pigment; black spot or dusky shade at dorsal base in front. Body compressed. . LYTHRURUS, 128.

jj. Scales not closely imbricated; those below dorsal scarcely reduced; body and fins with little or no pigment; dorsal inserted over ventrals (*Paranotropis*) or behind them (*Notropis*). A slender silvery species, the teeth with little or no grinding surface. . . . . NOTROPIS, 127.

cc. First (rudimentary) ray of dorsal enlarged, blunt, loosely joined to the first soft ray by membrane, this character best shown in adult males; teeth 4–4; scales before dorsal small; black blotch on front of dorsal and one at base of caudal always evident; carnivorous, aspect of *Hyborhynchus*. (*Pimephalinae*, in part.) CERATICHTHYS, 131.

bb. Lower lip developed as a fleshy lobe on each side; teeth sharp-edged, 4–4; isthmus very broad. . . . . PHENACOBIUS, 130.

aa. Mandible, suborbital, and interopercle with large cavernous areas like "silvery crossbars"; scales large, teeth 1, 4–4, 0; dorsal inserted above ventral. (Silvery fishes.) ERICYMBA, 129.

YY. Dentary bones parallel, united for their whole length, the lower jaw reduced to a tongue-like projection, which has a fleshy lobe on each side; premaxillaries not protractile; upper lip thickened; scales moderate; teeth 1, 4–4, 1, without grinding surface. Alimentary canal short, less than twice length of body; teeth hooked, the grinding surface, if present, narrow and rudimentary; peritoneum pale; species carnivorous. (*Exoglossinae*). . EXOGLOSSUM, 136.

XX. Alimentary canal long, usually more than 2 times length of body; teeth 4–4, little hooked, with oblique grinding surface; peritoneum generally black; dorsal inserted over ventrals; scales large; herbivorous species. (*Pimephalinae*, in part.)

m. First (rudimentary) ray of D. well developed, bluntish, separated from the first developed ray, to which it is joined by membrane (this character never conspicuous except in adult males, often obscure in young); scales before D. small (more than 20).

n. Lateral line complete; body rather elongate, little compressed. HYBORHYNCHUS, 132.

nn. Lateral line more or less incomplete, body chubby; color mostly black. PIMEPHALES, 133.

mm. First (rudimentary) ray of D. slender, firmly attached to the first developed ray; jaws sharp-edged, the lower with a slight projection in front; scales before D. large (less than 15).

o. Teeth long, scarcely hooked; suborbitals broad (*H. hayi* excepted); silvery species. . . . . HYBOGNATHUS, 134.

oo. Teeth short hooked; suborbitals very narrow; color dusky. . DIONDA, 135.

AA. Air bladder surrounded by many convolutions of the very long alimentary canal, which is 6 to 9 times length of body; peritoneum dark; mouth moderate, inferior, with thick lips and a rudiment of a hard sheath on the jaws; no barbels; dorsal above ventrals; anal short; scales moderate; lateral line complete; nuptial tubercles highly developed; herbivorous. (*Campostominae*.) . . . . . CAMPOSTOMA, 137.

104. CHROSOMUS Rafinesque (Gr., χρώς, color; σῶμα, body)

162. **C. erythrogaster** Rafinesque. RED-BELLIED MINNOW. Brownish olive, with black spots on the back, a blackish stripe from above eye straight to the tail, sometimes breaking up in spots behind; another below, broader, running through eye, decurved along the lateral line, ending in a black spot at base of C.; belly and space between bands bright silvery, brilliant scarlet red in spring males, as are the bases of the vertical fins; females obscurely marked.

D. 8; A. 9. Scales 16–85–10. L. 2½. N. B. to Colo.; abundant in small clear streams N. One of the most beautiful of our fishes; in high coloration the fins are bright yellow. It is the most desirable of all our minnows for aquarium purposes, being hardy, graceful, and gayly colored. (Gr., *ἐρυθρός*, red; *γαστήρ*, belly.)

163. **C. eos** Cope. Black lateral stripes uniting on caudal peduncle; otherwise much like the preceding, which it represents E. of Susquehanna R. (Gr., *ἠός*, sunrise.)

164. **C. oreas** Cope. Much like *C. erythrogaster*, but the upper stripe from above vent ending in a black spot running back, the lower stripe ending at base of anal, with no black spot at base of caudal. Roanoke R., Va. (Gr., *ὀρειάς*, a mountain nymph.)

105. NOTEMIGONUS Rafinesque (Gr., *νῶτος*, back; *ἡμι*, half; *γῶνος*, angle)

165. **N. crysoleucas** (Mitchill). Golden Shiner. Bream. Body more or less elongate, much compressed; head short, low, compressed; mouth small, oblique, the maxillary not to eye; eye moderate or large, 3 to 4 in head; lateral line much decurved. Greenish above; sides silvery with golden reflections; fins yellowish. Sexes similar. Head 4½; depth about 3. D. 8; A. 13 (10 to 14). Scales 10–51–3. L. 12. N. B. to the Dakotas and La.; everywhere abundant in sluggish or weedy waters. S. E. (N. C. to Ala.) occurs subspecies **bosci** (Cuvier & Valenciennes), with A. longer, about 16, and the lower fins scarlet in males. The two forms intergrade, and both are very variable. (*Cyprinus americanus* Linnaeus, 1766, not of 1758.) (Gr., *χρυσός*, gold; *λευκός*, white — hence correctly written *chrysoleucus*.)

106. OPSOPOEODUS Hay (Gr., *ὀψοποιέω*, to feed daintily; *ὀδούς*, tooth)

166. **O. emiliae** Hay. Body elongate, compressed; head short, the snout blunt and rounded; mouth very small, terminal, oblique, smaller than in other *Cyprinidae*; jaws equal; eye very large, 3 in head; D. behind V.; P. very small; breast naked; 16 scales before D.; lateral line usually nearly complete. Yellowish; sides silvery; a dark lateral stripe; D. with a black blotch on its first rays. Head 4¾; depth 4¾. D. 9; A. 8. Scales 5–40–3. L. 2¼. S. Mich. to Tex. and Miss., in sandy lowland streams; not common. (To Mrs. Emily Hay.)

107. OPSOPOEA Jordan & Evermann (Gr., *ὀψοποιέω*, to feed daintily.)

167. **O. bollmani** Gilbert. Head small; snout compressed and slender; mouth subinferior, nearly horizontal. Teeth 4–5 or 5–5, with grinding surfaces having one edge serrate. Dark olive, the scales edged with dusky; a black lateral band; chin black; a black spot nearly as large as eye at base of caudal. Kans. to Ga. (To C. H. Bollman.)

108. CLINOSTOMUS Girard (Gr., κλινός, slanting; στόμα, mouth)

168. **C. elongatus** (Kirtland). Body elongate, compressed; head long, pointed; mouth larger than in any other of our *Cyprinidae;* eye 4 in head; lateral line decurved. Dusky bluish, mottled with paler; a broad black lateral band, the front half of which is bright crimson in spring males. Head 4; depth 5. A. 9. Scales 10–70–5. L. 4. Pa. to Minn., chiefly northward, in clear brooks. (Lat., elongate.)

169. **C. vandoisulus** (Cuvier & Valenciennes). Head large; body deep; eye $3\frac{1}{2}$ in head. Bluish, some scales irregularly blackish; no black lateral band; spring males rose-red, especially anteriorly. Head $3\frac{2}{3}$; depth $3\frac{2}{3}$ to $4\frac{1}{4}$. A. 8. Lat. l. 53. N. J. to Ga.; common. (Fr., *vandoise*, dace.)

109. PFRILLE Jordan (German name for *Phoxinus phoxinus*)

170. **P. neogaeus** Cope. Body robust, little compressed; head very large, broad, with blunt snout; mouth moderate, oblique; chin projecting; maxillary beyond front of orbit; eye $3\frac{1}{2}$ in head; dorsal well behind ventrals. Blackish; sides plumbeous, with a dusky lateral band; lower parts crimson in spring males. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. A. 8. Scales 18–80–11. L. 3. Miss. Valley, N.; known from New Brunswick to South Dakota. (Gr., νέος, new; γέα, world; this being a near relative of the " Minnow " of Europe, *Phoxinus phoxinus* Linnaeus.)

110. HEMITREMIA Cope (Gr., ἡμι, half; τρῆμα, pore)

171. **H. vittata** Cope. Head rather short, the snout bluntish; mouth small, oblique; jaws equal, the maxillary to front of eye; lateral line with pores on 14 scales only. Color of preceding; the males largely scarlet; dark spot at base of C. Head 4; depth 4. A. 8. Scales 7–43–5. L. $2\frac{1}{2}$. Tennessee R. (Lat., striped.)

111. MARGARISCUS Cockerell (Gr., μάργαρος, pearl)

172. **M. margarita** (Cope). Body robust, little compressed; head blunt, thick, rounded; mouth small, the maxillary not to eye; barbels small, above tip of maxillary, often obsolete; eye rather large; lateral line decurved; dorsal behind ventrals. Dusky; sides plumbeous silvery, crimson in spring males. Represented S. by the typical subspecies **margarita.** Head 4; depth 4. A. 8. Scales 11–58–8. L. 3. Allegheny Mts., Pa. to Va.; scarce; a southern form. A pretty fish, similar to *Pfrille* in many respects, but the lateral line is nearly complete and the scales are larger. (Lat., pearly.)

Intergrading in the L. Ontario region with the N. W. subspecies, **M. m. nachtriebi** (U. Cox). Body rather heavy; head short, with blunt snout;

mouth moderate, little oblique, the maxillary reaching front of orbit; eye small, 4 in head; dorsal somewhat behind ventrals; lateral line complete in mature examples; often no barbels are evident. Dusky, with a faint black lateral stripe. Head $4\frac{1}{8}$; depth 5. Scales small, 12–72–9. Teeth 2, 4–5, 2. Lakes of Minn. and S. Dak. to New Brunswick. (Named for Dr. Henry Francis Nachtrieb, of the University of Minnesota.)

112. LEUCOSOMUS[1] Heckel (Gr., λευκός, white; σώμα, body)

173. **L. corporalis** (Mitchill). Fallfish. Chub. Roach. D. inserted midway between nostril and base of C.; barbel very small; eye $4\frac{1}{2}$ in head; 22 scales before D.; no dark dorsal spot; scales not crowded anteriorly. Bluish above; sides silvery; fins plain. Head 4; depth 4. D. 8; A. 8. L. 18. Quebec to Va.; abundant E. The largest of the *Cyprinidae* E. of the Rocky Mts. On the Pacific slope are species (*ptychocheilus, mylopharodon,* etc.) 5 to 6 feet in length. "The chub is a soft fish; it tastes like brown paper salted." (*Thoreau.*) (Lat., bodied.)

113. SEMOTILUS Rafinesque

(Gr., σῆμα, banner [dorsal fin]; *tilus* used by Rafinesque for spotted)

174. **S. atromaculatus** (Mitchill). Horned Dace. Creek Chub. D. inserted midway between pupil and base of C.; body robust; head large and broad; barbel minute, not evident in the young; mouth large, lower jaw included; eye small; scales crowded anteriorly, about 55; 30 scales before D. Dusky, little silvery; a conspicuous black spot at base of dorsal in front; a dark bar at shoulder; young with dark lateral band; ♂ more or less red and with coarse tubercles in spring. Head $3\frac{3}{4}$; depth 4. D. 7; A. 8. L. 12 or less. N. B. to the Dakotas, Va., and N. M.; very abundant, especially in small, clear brooks; variable. (*Semotilus corporalis* of authors, not of Mitchill.) (Lat., *ater*, black; *maculatus*, spotted.)

114. RHINICHTHYS Agassiz (Gr., ῥίν, snout; ἰχθύς, fish)

a. Snout long and prominent, projecting notably beyond the mouth, about twice length of eye in adult.

175. **R. cataractae** (Cuvier & Valenciennes). Long-nosed Dace. Body elongate, subterete; eye nearly median, 5 in head; barbel evident; P. enlarged in males. Dusky-olive, irregularly mottled; no distinct lateral band; a dusky spot on opercle; male with lips, cheeks, and lower fins crimson in spring. Head $4\frac{1}{3}$; depth $5\frac{1}{3}$. D. 8; A. 7. Scales 14–65–8. Teeth 2, 4–4, 2, L. 6. N. B. to Ore., S. in mts. to Va. and N. M., in clear mountain streams.

[1] Called *Chetlonemus* by Baird, there being an earlier genus, *Leucosoma* Gray.

Larger than *R. atronasus* and with longer snout. (*Leuciscus nasutus* Ayres; *Rhinichthys dulcis* Girard.) (Lat., of the cataract; first taken at Niagara.)

aa. Snout moderate, projecting little beyond the small mouth, its length 1⅓ times eye.

176. **R. atronasus** (Mitchill). Black-nosed Dace. Body moderately elongate; head rather large; eye small, 4½ in head; fins small; barbel minute, sometimes obsolete. Blackish, the scales mottled above; a black or brown lateral band, bordered above and below by pale; spring ♂ with this band and lower fins crimson, the color changing to orange in summer. Head 4; depth 4½. D. 7; A. 7. Scales 4–63–8. Teeth 2, 4–4, 2. L. 3. Me. to Iowa and Ala.; very abundant in all clear brooks. Variable. (Lat., *ater*, black; *nasus*. nose.)

115. EXTRARIUS Jordan (Lat., *extra*, superfluous)

177. **E. tetranemus** (Gilbert). Body long and slender, the head especially slim; all 4 barbels long, longest barbel equal to eye; fins large, dorsal over ventrals; snout 2½ in head, much projecting above mouth. Silvery, with black dots above; caudal dusky at base. Head 4; depth 5. D. 8; A. 8. Scales 37. Teeth 4–4. L. 2. Arkansas R. system. A singular little fish. (Gr., *τέτρα*, four; *νῆμα*, thread or barbel.)

178. **E. aestivalis** (Girard). Very slender; eye small, 4 in head. Head 3¾; depth 5⅓. Scales 36. One rather long barbel, and another more or less rudimentary on each side. Platte R., and S. (Lat., of the summer.)

179. **E. hyostomus** (Gilbert). Very slender; snout long, acute, projecting half its length beyond the mouth, which is short, wide, and inferior; eye rather large, 3¼ in head; pectorals long, other fins small; 13 scales before D. Head 4; depth 5½. Scales 37. One moderate barbel on each side. S. Ind. and Tenn. to Iowa. (Gr., *ὗς*, pig; *στόμα*, mouth.)

116. MACRHYBOPSIS Cockerell & Alliston (Gr., *μακρός*, long; *Hybopsis*)

180. **M. gelidus** (Girard). Very slender; snout long, thick, blunt, overhanging the rather large mouth; fins high, P. 1½ in head; lower lobe of caudal black. Head 4; depth 5½. A. 7. Scales 44. L. 2. Missouri R. basin, Ia. to Mont., in the river channels; not ascending brooks. (Lat., frozen.)

117. ERIMONAX Jordan (Gr., *ἐρι*, very; *μόναξ*, a monk)

181. **E. monacus** (Cope). Body slender; head long and slender; eye 4⅓ in head; 24 scales before D. Olivaceous; sides silvery; a black spot at base of C. and one on last dorsal rays; no laterals tripe; scales not speckled. Head 4; depth 5½. A. 8. Scales 8–56–4. L. 4. Tennessee R. (Lat., monastic; i.e. solitary.)

118. ERIMYSTAX Jordan (Gr., ἐρι, very; μύσταξ, barbel)

182. **E. dissimilis** (Kirtland). Body very long and slender; head long, the snout blunt at tip, projecting beyond the small mouth; eye very large, 2¾ in head; P. long; 22 scales before D; dorsal before ventrals. Olivaceous, with dusky lateral band, along which are several large, round, dusky spots, the most distinct at base of C. Head 4½; depth 5½. D. 8; A. 7. Scales 6–47–5. Teeth 4–4. L. 5. L. Erie to Ala. and Iowa. (Lat., unlike.)

183. **E. watauga** (Jordan & Evermann). Like *E. dissimilis*, but more elongate, the scales smaller, and the color less marked but of similar pattern. Head 4½; depth 5⅔. D. 7; A. 7. Scales 5–50–4. L. 4. Holston and Watauga rivers, N. W. to upper Wabash R.

119. ERINEMUS Jordan (*Hybopsis* Jordan, not of Agassiz)
(Gr., ἐρι, very; νῆμα, thread)

184. **E. hyalinus** Cope. Body slender; head large, flattish above; eye longer than snout, 3 in head; mouth small; snout bluntly decurved; 16 scales before D. Greenish; sides with a blackish or plumbeous stripe extending around snout, overlaid by silvery. Head 4; depth 5. Scales 5–38–4. L. 4. Ohio Valley to Tennessee R. and N. E. to N. Y.; common. Smaller than *E. storerianus* and somewhat different in color. (? *Rutilus amblops* Rafinesque.) (Lat., translucent.)

185. **E. labrosus** (Cope). Head 4¼; depth 4¼; D. 8; A. 7 or 8; scales 5–34 to 40–3. Head rather long and narrow; snout overhanging large mouth; lips much thickened, with an internal fringe of papillae; barbels more than half eye. N. C. and S. C. (Lat., thick lipped.)

186. **E. hypsinotus** (Cope). Head 3¾; depth 4. D. 8; A. 8. Scales 5–40–3. Body stouter; head short and broad. Mouth small, inferior; barbels small. N. C. and S. C. (Gr., ὑψί, high; νῶτος, back.)

187. **E. storerianus** (Kirtland). Body rather elongate; back elevated; tail long. Head short, broad between eyes; eye equal to snout, 3 in head; preorbital broad, conspicuous, silvery; snout abruptly decurved, its tip fleshy; lateral line decurved; fins high. Light olive; sides brightly silvery without dusky shades; fins all pale. Head 4⅓; depth 4. D. 8; A. 8. Scales 5–42–4. L. 4 to 8. Ohio to Neb. and Tenn.; abundant in larger streams. A handsome fish, resembling *Notropis hudsonius*. (To David Humphreys Storer, author of *Fishes of Massachusetts*.)

120. NOCOMIS Girard (An Indian name, the "daughter of the Moon") (*Ceratichthys* Baird, not of Baird and Girard)

188. **N. biguttatus** (Kirtland). Horny Head. River Chub. Jerker. Robust; head large, broad above, the snout long, bluntish; mouth large, little oblique, the lower jaw shorter; eye small, suborbitals narrow; barbel

evident; scales not crowded forwards, 18 before D.; dorsal slightly behind ventrals. Bluish olive, with coppery shades; a dark bar behind opercle; fins pale orange, unspotted, red in young; young with a black spot at base of C. Adult males in spring with the whole upper part of head covered with large tubercles; a round crimson spot on each side of head. Head 4; depth $4\frac{1}{2}$. D. 8; A. 7. Scales 6–41–4. Teeth 4–4 or 1, 4–4, 1. L. 10. Ohio to Colo. A large dace, very abundant in the rivers; entering small brooks. (Lat., two-spotted.)

189. **N. micropogon** (Cope). Male with a high crest, the tubercles all lying in front of it; no definite caudal spot; no red spot on head; otherwise much as in the preceding. Mich. to Mass. and S.; chiefly in larger streams. (Gr., *μικρός*, small; *πώγων*, beard.)

121. COUESIUS Jordan (To Dr. Elliott Coues)

190. **C. plumbeus** (Agassiz). Body rather elongate; head small; snout bluntish; mouth rather small, terminal; eye 4 in head; D. above V. Dusky; a plumbeous lateral band; fins plain. Head 5; depth 5. D. 8; A. 7. Scales 11–68–7. Teeth usually 2, 4–4, 2. L. 6. S. Canada and N. U. S., from N. B. to Mont., chiefly in or near cold lakes. (*C. dissimilis* Girard.) (Lat., leaden.)

122. PLATYGOBIO Gill (Gr., *πλατύς*, broad; Lat., *gobio*, gudgeon)

191. **P. gracilis** (Richardson). Flat-headed Chub. Body elongate; head short, small, very broad and depressed above, the interorbital area 2 in head; mouth large, oblique; eye small, 6 in head; fins large; 23 scales before D. Very pale; sides silvery; young with a dusky lateral shade. Head $4\frac{1}{4}$; depth $4\frac{3}{4}$. D. 8; A. 8. Scales 6–50–5. L. 12. Missouri Basin and N.; S. to Okla. (Lat., slender.)

Notropis

123. HYBOPSIS[1] Agassiz (*Alburnops* Girard; *Miniellus* Jordan) (Minnows) (Gr., *ὑβός*, blunt; *ὄψις*, face)

Species with the teeth in main row 4–4, those of the lesser row 1, or none, rarely 2, the lesser row often wanting; mouth small; scales not closely imbricated, those before dorsal not reduced; dorsal inserted nearly over ventrals; anal short, its rays 8 or 9; no black blotch on dorsal; colors rarely brilliant.

a. Teeth one-rowed (often two-rowed in *heterodon*), the grinding surface more or less developed on at least one or two teeth.

b. Lateral line usually more or less incomplete (often complete in *anogenus* and *atrocaudalis*); small species with a dusky to black lateral band continued on to snout. (Subgenus *Chriope* Jordan.)

[1] This analysis of the species of *Hybopsis*, *Hydrophlox*, and *Cyprinella* found within our limits is mainly furnished by Carl Leavitt Hubbs. These genera, with *Luxilus* and *Lythrurus*, Mr. Hubbs prefers to unite with *Notropis*, the oldest name applied to any of these small minnows.

c. Lateral stripe surrounding muzzle confined to chin and premaxillaries; mouth more oblique; jaws about equal anteriorly.
d. Mouth rather large, moderately oblique; maxillary extending beyond anterior nostril almost to below eye. Peritoneum silvery.
e. Jaws equal or nearly so; eye larger, longer than snout, nearly ⅓ head; A. 8. *heterodon*, 204.
ee. Lower jaw somewhat included; eye shorter than snout, decidedly less than ⅓ head; A. 7 or 8 . . . . . *nux*, 209.
dd. Mouth very small, nearly vertical; maxillary extending only to below anterior nostril. Peritoneum blackish. . . . . *anogenus*, 201.
cc. Lateral stripe in surrounding muzzle extended on to snout above premaxillaries; encroaching little or not at all on chin. Lower jaw distinctly included.
f. Lateral line very incomplete.
g. Premaxillaries strictly terminal; mouth moderately oblique; lateral band nearly solid.
h. Length of depressed D. more than ⅔ its distance from occiput; D. inserted nearer tip of snout than base of C. . . . . *bifrenatus*, 202.
gg. Premaxillaries slightly included within tip of snout; mouth nearly horizontal; lateral band comprising black crescents on scale rows of trunk. *heterolepis*, 203.
ff. Lateral line nearly or quite complete; lateral stripe nearly solid; D. inserted nearer tip of snout than base of C. . . . . *atrocaudalis*, 205.
bb. Lateral line complete. (Subgenus *Hybopsis*.)
i. Mouth distinctly inferior and horizontal, overhung by a gibbous snout; breast scaleless; eye large. . . . . *nocomis*, 198.
ii. Mouth terminal or nearly so.
j. Eye more than ¼ head; upper jaw less than ⅓ head; breast scaled.
k. Body rather slender, the depth less than ¼ the length (except in some ripe females).
l. Ana rays 7; lateral line scales not especially elevated; dark markings well developed.
m. Lateral band indefinite. . . . . *deliciosus*, 192.
mm. Lateral band blackish. . . . . *procne*, 193.
ll. Anal rays 8; lateral line scales much elevated (exposed surfaces 3 times as high as long) . . . . . *volucellus*, 194.
lll. Anal rays 9.
n. Lateral band not developed, no spot at base of C. *kanawha*, 197.
nn. Lateral band developed; black spot at base of C. *spectrunculus*, 196.
kk. Body chubby, the depth more than ¼ the length. *topeka*, 206.
jj. Eye less than ¼ head; upper jaw more than ⅓ head; breast more or less devoid of scales; A. 7 to 9. . . . . *girardi*, 195.
aa. Teeth two-rowed (1, 4–4, 0 or 1, 4–4, 1) — (See also division *aa* of key); A. usually 8.
o. Maximum size less than 3 inches; mouth larger (upper jaw contained fewer than 3.5 times in the head).
p. Eye very large (contained less than 3.3 times in head), decidedly longer than snout; mouth oblique; lips thin. . . . . *boops*, 200.
pp. Eye moderate (contained more than 3.3 times in head), decidedly shorter than snout; mouth horizontal; lips thick. . . . . *dorsalis*, 199.
ppp. Eye moderate, less than ⅓ head; usually 7 anal rays. . . . . *blennius*, 208.
oo. Maximum size over three inches; large silvery fishes, the teeth two-rowed, the lesser row often with two teeth. (Subgenus *Hudsonius* Girard.) . . . *hudsonius*, 207.

192. **H. deliciosus** (Girard). Straw-colored Minnow. Body stoutish, little compressed; head rather broad; mouth small, horizontal, inferior; snout obtuse; eye large, 3 in head; lateral line always complete. Pale olivaceous; sides pale, but sometimes with a faint dusky stripe. Head 4; depth 5. Scales 32 to 38. A. 7. Teeth always 4–4. L. 2½. Miss. Valley chiefly; locally

very abundant. An insignificant little fish, running into several tangible subspecies, or perhaps distinct species. Subspecies **stramineus** Cope is the Great Lakes and St. Lawrence form; scales 35 to 38. Subspecies **missuriensis** (Cope), occupying most of the Miss. basin, has scales 32 to 35, the snout longer; fins longer, P. reaching V. (? *Minnilus microstomus* Rafinesque, Ohio R.; ? *Hybopsis gracilis* Agassiz, Tennessee R.) (Lat., delicious.)

193. **H. procne** (Cope). Slender, with the tail long; snout blunt; mouth inferior, small; 13 scales before D.; eye large. Olivaceous; a dark lateral band. Head $4\frac{3}{4}$; depth $5\frac{1}{4}$. A. 7. Scales 5–32–3. L. $2\frac{1}{2}$. Delaware R. to Neuse R., N. C., in coastwise streams; abundant. (Gr., *πρόκνη*, a swallow or martin.)

194. **H. volucellus** (Cope). Body rather robust but angular; mouth terminal and somewhat oblique; fins more or less sharp and long. A. 8. Scales 31 to 38, markedly deepened along lateral line. Teeth 4–4. L. 2. S. Ont. and Minn. to Ky. and Okla. Represented N. by typical subspecies, and S. by subspecies **buchanani** Meek, with very high fins and pale color. (Lat., dim. of *volucer*, winged.)

195. **H. girardi** Hubbs & Ortenburger. Eye less than $\frac{1}{4}$ head, less than $\frac{2}{3}$ snout, only $\frac{2}{3}$ interorbital; upper jaw 3 in head. Teeth 4–4. Scales 36 in lat. l., 16 to 20 before dorsal. Dorsal well before middle of total length. Arkansas R. system. (Diagnosis from Hubbs & Ortenburger Ms.) (To Charles Girard.)

196. **H. spectrunculus** (Cope). Body elongate, head large and broad; eye 3 in head; snout thick; mouth terminal, oblique; premaxillaries in front on level of middle of pupil; 15 scales before D. Olivaceous; dark above; a plumbeous lateral stripe and distinct black caudal spot; ♂ with fins orange. Head 4; depth $5\frac{1}{2}$. A. 9. Scales 37. Teeth 4–4. L. 3. Tennessee R. (Lat., a little image.)

197. **H. kanawha** (Jordan & Jenkins). Much like *H. spectrunculus*, but lacking lateral stripe and caudal spot. Head $4\frac{2}{5}$; depth $4\frac{3}{5}$. D. 8; A. 9. Scales 37. Teeth 4–4. Kanawha R., W. Va.

198. **H. nocomis** Evermann. Mouth very small, inferior, with thick, fleshy lips; body short and deep; snout heavy and rounded; eye very large, $3\frac{1}{2}$ in head; breast naked; fins low. Silvery; sides with black specks. Head 4; depth $3\frac{3}{4}$. A. 8. Teeth 4–4. Lat. l. 35. L. $2\frac{1}{2}$. St. Louis to Texas. (Named for its resemblance to the genus *Nocomis*.)

199. **H. dorsalis** (Agassiz). Heavy forward, but with long, slender tail; head long, flattish above; snout moderate; mouth rather large, little oblique, the lower jaw included; eye moderate, 4 in head; scales before D. 17; D. slightly behind V. Greenish; sides with dusky streak and dark specks. Head 4; depth 5. A. 8. Scales 5–35–4. Teeth 1, 4–4, 1. L. $2\frac{1}{2}$. Mo. and Nebr. to Minn. and N. Y. (*Notropis gilberti* Jordan & Meek.) (Lat., *dorsum*, back.)

200. **N. boops** Gilbert. Body compressed, the back elevated; tail slender; snout short, not blunt; mouth terminal, very oblique, lower jaw not included; eye very large, 2½ to 3 in head; maxillary to front of eye; D. over V.; 12 scales before dorsal. Olivaceous; sides with dusky streak and dark specks. Head 3¾; depth 4⅛. A. 8. Scales 5–36–2. Teeth 1, 4–4, 1, with deep grinding surface, the inner edge strongly crenate. L. 3. S. Ind. to Iowa and Ark.; common S. W. in cold streams. (Gr., βοῦς, bull; ὤψ, eye.)

201. **H. anogenus** Forbes. Similar to *H. heterodon*, but with lateral line usually complete; mouth very small and very oblique, the lower jaw short and included, the upper lip above level of pupil; snout short, blunt. Dusky; a very distinct lateral band and a black spot at base of C.; a black speck on each pore of lateral line; scale margins especially darkened. Head 4¼; depth 4⅔. A. 7 or 8. Teeth 4–4. Lat. l. 34 to 37. L. 1½. W. N. Y. to N. D. (Gr., ἀ, without; γέννς, chin.)

202. **H. bifrenatus** (Cope.) Body slender, the tail contracted; upper lip on level of lower part of pupil; jaws equal; eye large, 3 in head; lateral line very short; scales before dorsal large, usually 12 or 13 in number; lateral band narrow on snout. Straw color, with jet-black lateral band, bordered with orange on snout. Head 4⅓; depth 4⅕. D. 8; A. 7. Scales 5–36–3. Teeth 4–4. L. 2. W. N. Y. to Me. and Md.; locally common. (Lat., two-bridled.)

203. **H. heterolepis** Eigenmann & Eigenmann. More slender than *H. bifrenata;* the fins lower; the dorsal farther backward, behind ventrals; scales before dorsal irregular and crowded, 13 to 22 in number; lateral band on snout broad. Maine and Ohio, W. and N. W. (*Notropis muskoka* Meek.) (Gr., ἕτερος, different; λεπίς, scale.)

204. **H. heterodon** (Cope). Body rather stout; eye 3 in head; lateral line usually developed about halfway, sometimes nearly complete. Olive; sides with dusky plumbeous band, fainter than in *bifrenatus;* chin black. Head 4; depth 4. A. 8. Scales 5–36–3. Teeth 4–4 or 1, 4–4, 1 crenate. L. 2½. W. N. Y. to Minn.; common. (Gr., ἕτερος, differing; ὀδών, tooth.)

205. **H. atrocaudalis** (Evermann). Head short or bluntly conic; eye 3⅓ in head. Lat. l. complete or nearly so. D. inserted before middle of standard length. A black stripe through snout and eye; a black caudal spot; no dark cross-hatching on rows of scales. Head 4⅔; depth 4⅔. D. 8; A. 7. Scales 7–36–4, 13 before dorsal. Minn. to Texas. (Lat., black-tailed.)

206. **H. topeka** Gilbert. Body compressed, stout; snout blunt; mouth small, terminal, oblique; eye 4⅓ in head; 14 scales before D.; lateral line anteriorly decurved. Olivaceous; a dusky lateral streak, ending in a small caudal spot; males with sides and fins bright red. Head 4; depth 3⅔. A. 7. Scales 5–35–4. L. 2¾. W. Iowa to Kans. (Named for Topeka, Kansas.)

207. **H. hudsonius** (De Witt Clinton). Spawn Eater. Spot Tail. Body elongate, moderately compressed; head short, with blunt snout; eye

very large, 3 to 3½ in head; mouth small, subinferior; lateral line slightly decurved; 12 to 18 scales before dorsal; fins rather small. Pale olive; young always with a round black spot at base of caudal, sometimes a dark lateral band; fins unmarked. Head 4½ to 5; depth 4½ to 5. D. 8; A. 8. Scales 5–39–4. Teeth variable, usually but not always 2 in one of lesser rows, sometimes none of them with grinding surface. L. 5. Great Lakes and S. E., in coastwise rivers; abundant and very variable. Northern specimens usually have teeth 2, 4–4, 1. The species seldom ascends small streams. Represented N. by subspecies **selene** Jordan. Head very short; mouth more oblique; caudal spot very conspicuous. L. Superior, and W. and N. (*Notropis scopiferus* Eigenmann & Eigenmann.) Represented S. E. by subspecies **amarus** Girard. Teeth usually 1, 4–4, 1 or 0; otherwise much as in *H. hudsonius*, but rather smaller. Va. to Ga. (Named for the Hudson River.)

208. **H. blennius** (Girard). Rather slender; eye large, equal to snout, 3⅔ in head; head flattish above, the snout blunt and rounded; mouth rather large, oblique; dorsal inserted over ventrals; 16 scales before dorsal. Pale, a broad silvery band, overlying plumbeous. Head 4; depth 4⅔. D. 8; A. 7. Scales 5–37–3. Teeth 2, 4–4, 1. L. 3½. Illinois R. to Ark. and Winnipeg. (*Episema jejuna* Forbes.)

209. **H. nux** Evermann. Body slender; compressed, much as in *Hybopsis heterodon;* head small, snout short and sharp, 4 in head; mouth small, oblique; eye very large, 3 in head; dorsal just before ventrals; lateral line complete. Dark olive; scales with dark edges; a dusky streak on sides, ending in a caudal spot and extending forward around snout; dark specks along lateral line. Head 4; depth 4⅔. D. 8; A. 7. Scales 37, 13 before dorsal. Teeth 2, 4–4, 2, some of them denticulate. L. 2. Sluggish streams from Minn. to Tex. (Described from examples from Switz City Swamp, Indiana, noted by Dr. Gilbert, who referred them provisionally to *Hybopsis heterodon;* see Jordan and Evermann, *Fishes of North and Middle America*, Vol. I, page 261; 1896.) Represented in N. Ill., N. E. Ia., and S. Minn. to Mich. by subspecies **richardsoni** Hubbs and Greene, which has the lat. l. incomplete and teeth of lesser row often single. (Lat., nut, the types having come from the Nueces R., Texas.)

Notropis

124. CYPRINELLA Girard (Satinfins) (*Moniana* Girard) (Dim. of *Cyprinus*)

a. No black blotch on dorsal fin; scales closely imbricated. (Subgenus *Cyprinella.*)
  b. Teeth one-rowed, 4–4. . . . . *lutrensis*, 210.
  bb. Teeth two-rowed; mouth larger. . . . . *cummingsi*, 216.
d. Dorsal fin with a large black blotch on the posterior rays, spring males tipped with silvery pigment. (Subgenus *Erogala*, Jordan.)

c. Anal rays 8 or 9; caudal fin without a blackish cross band.
e. Scales larger, 34 or 35 in lateral line. . . . . *analostanus*, 213.
ee. Scales smaller, 36 to 41 in lateral line.
f. Caudal fin not creamy yellow at base.
g. Head more slender; a blue streak on caudal peduncle. . . *niveus*, 212.
gg. Head deeper; no blue streak on caudal peduncle. . . . *whipplii*, 211.
ff. Caudal fin conspicuously creamy yellow at base. . . . . *galacturus*, 214.
cc. Anal rays usually 10; caudal with a blackish cross-band; colors brilliant. *pyrrhomelas*, 215.

210. **C. lutrensis** (Baird & Girard). Red-fin Minnow. Adult with the body deep, strongly compressed, the back arched; young variously elongate or elliptical; head short, blunt; mouth moderate, oblique, the lower jaw included; eye 4 in head; lateral line strongly decurved; 13 to 15 scales before D. ♂ steel-blue, profusely tuberculate, belly and fins blood-red, a violet and a crimson crescent behind shoulder; ♀ plain; fins unspotted. Head $3\frac{2}{3}$; depth $2\frac{5}{6}$ (adult) to 4 (young). A. 8. Scales 6–35–2. Teeth crenate; usually 4–4. L. 3. S. Ill. to Rio Grande; very abundant S. W. A very brilliant and very variable little fish. (Lat., *lutra*, otter; first known from Otter Creek, Ark.)

211. **C. whipplii** (Girard). Silverfin. Satinfin. Body subelliptical, the adult much compressed; head short, not very blunt; mouth rather small, oblique, the lower jaw shorter; eye small, $4\frac{1}{2}$ in head; males with high fins. Bluish silvery; scales dusky-edged; a dark vertebral line; dorsal blotch large in adult, wanting in young; no creamy band across base of C. Head $4\frac{1}{4}$; depth 4. A. 8. Scales 5–38–3. Teeth serrate. L. 4. W. N. Y. to Tenn. and Minn., S. to Ark.; abundant, westward. The northern form is **C. w. spilopterus** (Cope). (To Captain A. W. Whipple, U. S. A.) (*Hybopsis fretensis* Cope, the young.)

212. **C. niveus** (Cope). Very similar to *whipplii*, but with slenderer head and a blue streak on caudal peduncle. S. Va. to S. C. (Lat., snowy.)

213. **C. analostanus** (Girard). Eastern Silverfin. Very similar to *C. whipplii*, but a little deeper, the scales larger, 35 in number. Depth $3\frac{1}{2}$; Susquehanna R. to James R.; represented further S. by the closely related *N. niveus* Cope. (From Analostan Island in the Potomac.)

214. **C. galactura** (Cope). Similar to the preceding, but larger, more elongate, and less compressed, the scales less closely imbricated, lateral line less decurved; teeth usually not serrate; lower jaw included. Color like preceding, but more silvery; C. dusky, its basal third bright creamy yellow. Head $4\frac{1}{3}$; depth $4\frac{1}{3}$. A. 8. Scales 6–41–3. L. 6. Ozark region, E. to E. Tenn. and Savannah R., in mountain streams. (Gr., γάλα, milk; οὐρά, tail.)

215. **C. pyrrhomelas** (Cope). D. 8; A. 10; scales 6–35–3; teeth 1, 4–4, 1. Body deep and compressed; head stout; eye 3; mouth oblique; maxillary to front of orbit. Males steel-blue above, milky white below; head mostly reddish, but scarlet on tip of jaw, snout, and iris; D. red in front, with

black blotch and milk-white tip; C. red, black, and white. The most ornate of our Cyprinidae. Santee basin, N. C. (Gr., πῦρ, fire; μέλας, black.)

216. **C. cummingsi** Myers. Head 4½; depth 4 to 4⅔; D. 7 or 8; A. 9 to 11; scales 7–38 to 40–3; 18 to 20 before D; eye 3¾. Back dull green; a steel-blue lateral band from snout to C.; fins clear. Wilmington, N. C. (Named for Mrs. J. H. Cummings.)

125. LUXILUS Rafinesque (Shiners) (*Hypsolepis* Baird) (Lat., *lux*, light)

217. **L. cornutus** (Mitchill). Common Shiner. Redfin. Horned Dace. Body short, compressed in the adult, in the young elongate; head heavy, interorbital area rounded; snout bluntish; mouth moderate, scarcely oblique; lower jaw included; eye 4 to 5 in head; lateral line decurved; 13 to 45 scales before D. Adult steel-blue, with gilt lines in life; sides silvery; fins pale; a dark shade behind shoulder; spring males tuberculate, with the belly and lower fins bright rosy. Head 4⅓; depth 3 to 5. A. 9. Scales 6–41–3. L. 8. In all brooks from Me. to Rocky Mts., S. to Neuse R., N. C. Excessively abundant and variable. (Lat., horned.)

Several subspecies have received names:

L. cornutus frontalis (Agassiz). Slender; 23 to 45 scales before dorsal; size large. Colo. to N. B.; N. and N. W.

L. cornutus cornutus (Mitchill). Intermediate between *frontalis* and *chrysocephalus*. N. E. to Va.

L. cornutus chrysocephalus (Rafinesque). Robust; 14 to 23 scales before D. Mich. to Ala. (Gr., χρύσος, golden; κεφαλή, head.)

L. cornutus cerasinus (Cope). A small form, especially brilliant; sides with dark crossbars formed of dark edgings of the scales. Head 4; depth 3⅔. Scales 6–37–3; 15 before dorsal. L. 4 or less. Upper Roanoke R., in mountain streams.

L. cornutus albeolus Jordan. More elongate than *L. cornutus;* eye 3½ in head. Body and fins very pale; snout silvery. Depth 4. Scales 38; 14 before dorsal. L. 5 to 7. Roanoke R. to Neuse R., in lowland streams. Possibly a distinct species.

126. HYDROPHLOX Jordan & Brayton (Gr., ὕδωρ, water; φλόξ, flame)

Rather small species, with the scales more rounded and less imbricated than in *Luxilus*, the exposed surfaces not much deeper than long.

a. Interorbital little convex, so that the eye is much nearer dorsal than ventral contour of head; no black blotch on the dorsal; spring males with much red.

b. Species generally with much pigment, mostly of the Southeast; teeth with the grinding surface developed.

c. Lower jaw projecting; dorsal inserted somewhat behind ventrals; males with red. (Subgenus *Coccotis*, Jordan.)

d. Eye less than ¼ head; maxillary reaching only to below front of eye.

macdonaldi, 219.

dd. Eye more than ¼ head; maxillary reaching well beyond front of eye.
coccogenis, 218.

cc. Lower jaw included or scarcely projecting. (Subgenus *Hydrophlox.*)

e. Base of caudal without a dark spot.
lacertosus, 221; *zonatus*, 220; *rubricroceus*, 222; *chlorocephalus*, 223; *brimleyi*, 224.

ee. Base of caudal with a distinct dark spot.
chalybaeus, 225; *chiliticus*, 226; *altipinnis*, 227.

218. **H. coccogenis** (Cope). Body elongate, compressed; head pointed; mouth large, very oblique, the maxillary past front of eye, lower jaw the longer; teeth with narrow grinding surface; eye very large, 3½ in head; 20 scales before D. Olivaceous, silvery below; males with a scarlet vertical band on preopercle; a red axillary spot; snout and belly rosy; a dark scapular band; outer half of D. and C. dusky. Head 4; depth 4¼. A. 9. Scales 7–42–3. L. 5. Mountain streams, Ky. to Ga. A brilliant fish, resembling *Clinostomus*. (Gr., κόκκος, cherry-red; γένειον, cheek.)

219. **H. macdonaldi** Jordan & Jenkins. Body a little slenderer than in *N. coccogenis;* a diffuse lateral wash of silvery; mouth a little smaller, as is also the eye (4⅛). Head 3¾; depth 4¾. Scales 42. Tributaries of the James and Shenandoah rivers in Va. (To Marshall McDonald, late Commissioner of Fisheries.)

220. **H. zonatus** (Agassiz). Body rather elongate; head long, not acute; jaws equal; maxillary 3 in head, not to eye; snout shortish; eye very large, 3 in head; lateral line decurved; 16 scales before D. ♀ and young olivaceous, with plumbeous lateral band and no caudal spot; ♂ in spring with black lateral band, sides and lower parts flame-red. Head 4¼; depth 4⅔. A. 9. Scales 6–39–4. L. 5. Ozark region. (Lat., banded.)

221. **H. lacertosus** (Cope). Body stout, with large head; mouth wide, the lower jaw projecting, maxillary not to eye; eye large, 3¼ in head, equal to snout or interorbital. Silvery; D. dusky. Head 4. Scales 5 above lat. 1. L. 4½. Holston R., Tenn. (Lat., lizard-like.)

222. **H. rubricroceus** (Cope). Red Fallfish. Head rather pointed; mouth oblique, rather large, the jaws equal; eye large, 3½ in head; lateral line decurved; 19 scales before D. Blue, with black lateral band, the whole body more or less suffused with blood-red; ♀ pale. Head 4; depth 4½. A. 9. Scales 7–38–8. L. 2½. Mountain torrents, on both sides of Great Smoky Range. A most exquisite little fish. (Lat., saffron-red.)

223. **H. chlorocephalus** (Cope). Head 4; depth 5; D. 8; eye 3; scales 6–39–3. Body stout; caudal ped. deep; head broad; mouth large and oblique. Olivaceous, dusted with blackish specks forming a lateral band terminating in dusky spot; top of head green; belly crimson in males; lower jaw not black. Santee basin, N. C. and S. C. (Gr., χλωρός, green; κεφαλή, head.)

224. **H. brimleyi** Bean. Head 4; depth 5⅓; eye 3⅓; scales 4–43–3; D. 9; A. 9. Light green above, with dark specks; silvery-white below; a

plumbeous lateral band; a dark shoulder band; posterior part of D. and C. black. Cane R., N. C. (To H. H. Brimley.)

225. **H. chalybaeus** (Cope). Body slender, the back elevated; snout pointed; mouth oblique, lower jaw projecting; lateral line decurved; eye 3 in head; 18 scales before D. Brown; a jet-black lateral band; ♂ bright orange below. Head 3¼; depth about 4¼. A. 8. Scales 6–35–3. L. 2. Delaware R. and S. (Lat., steel-colored.) Subspecies **abbotti** Fowler, dark markings deeper. Batsto R., N. J.

226. **H. chiliticus** (Cope). Head 4; depth 5½; eye 3; D. 8; A. 8; scales 7–36–2. Body elliptical ; mouth large, reaching beyond front of orbit. Olivaceous; a distinct silvery band along sides; males with lips and snout vermilion; a band of same color through D. and A. Yadkin R. system, N. C. (Gr., χεῖλος, lip.)

227. **H. altipinnis** (Cope). Head 4⅓; depth 3½; eye 2¾; D. 8; A. 9; scales 5–36–2. Like *chalybaeus*, but more robust. Greenish; a silvery lateral band strongly punctate with black; a black band across eye and snout; lower jaw blackish. Streams of pine woods (Yadkin R. to Cape Fear), N. C. (Lat., *altus*, high; *pinnis*, fin.)

127. NOTROPIS Rafinesque (Silverlings) (*Alburnellus* Girard) (Gr., νῶτος, back; τρόπις, keel —the type specimen was sun-dried.)

Elongate species with little pigment, which may be red, black or silvery; anal fin generally long; teeth 2, 4–4, 2, without grinding surface; scales not closely imbricated.

a. Dorsal fin inserted above ventrals. (Subgenus *Paranotropis*, Fowler.)
  b. Eye very large, more than ½ head; anal rays 8 or 9.
    e. Caudal with a jet black spot; dorsal inserted behind ventral insertion. *leuciodus*, 228.
  cc. Caudal with no definite spot; dorsal inserted nearly over ventral insertion.
    d. Anal rays 8. . . . . *scabriceps*, 229.
    dd. Anal rays 9. . . . . *ariommus*, 230.
aa. Dorsal fin inserted behind ventrals; anal long, usually with 10 to 13 rays; no caudal spot. (Subgenus *Notropis*.)
    e. Scales loosely imbricated, the exposed surfaces not notably deeper than long; bright silvery species. *photogenis*, 231; *amoenus*, 232; *telescopus*, 233; *scepticus*, 234; *stilbius*, 235; *rubrifrons*, 236; *atherinoides*, 237; *micropteryx*, 238.

228. **N. leuciodus** (Cope). Slender; snout rounded; mouth oblique, the lower jaw not projecting; lateral line nearly straight; 12 scales before D. Silvery; a purplish lateral band; a black spot at base of C. Head 4½; eye very large. A. 8. Scales 5–39–3. L. 3. Tennessee R. system. (Gr., λευκός, white.)

229. **N. scabriceps** (Cope). Stout; head heavy, flattish above, with blunt snout; mouth little oblique; lateral line decurved; fins small. Olive, with a silvery plumbeous lateral band. Head 4; depth 4¼; eye very large. A. 8. Scales 6–38–3. Kanawha R., W. Va. (Lat., *scaber*, rough; *ceps*, head.)

230. **N. ariommus** (Cope). Head 3¾ to 4¼; depth 4¼ to 5; D. 8; A. 9; scales 6–39–2; body stout; eye 2⅔. Bright silvery, becoming olivaceous above. Ohio to Va. and Ala. (Gr., *ἀρι* —, an intensive particle; *ὄμμα*, eye.)

231. **N. photogenis** (Cope). Slender, compressed; mouth oblique, the jaws subequal, maxillary not quite to orbit; lateral line decurved; eye large, 3⅓ in head, as long as snout. Greenish; sides silvery. Head 4¼; depth 5½. A. 10. Scales 6–40–3. L. 3. Pa. and N. C. to Ind. and Mich., W. of Allegheny Mts. (Gr., *φώς*, light; *γένυς*, cheek.)

232. **N. amoenus** (Abbott). Similar to *photogenis* and *rubrifrons*, and representing these species E. of the Alleghenies. (Lat., attractive.)

233. **N. telescopus** (Cope). Similar to preceding, the D. farther forward, not much behind V., midway between snout and C.; mouth oblique, the jaws subequal; eye very large, 2¾ in head. Scales above dark-edged. Head 4¼; depth 5. A. 10. Scales 5–38–3. L. 3½. Tennessee R.; abundant. (Gr., *τηλεσκόπος*, far-seeing.)

234. **N. scepticus** (Jordan & Gilbert). Head 3¾; depth 4⅓; eye 3; D. 8; A. 10; scales 6–38–3. Body short and deep. Very pale green, with a silvery lateral band. N. C. and S. C. (Gr., *σκεπτικός*, observant.)

235. **N. stilbius** Jordan. Head 4⅕; depth 5; eye 3; D. 8; A. 10; scales 5–37–2. Mouth large and oblique; snout shorter than eye. D. farther back than in *telescopus*. Pale green, with a broad silvery band; usually a faint C. spot. Tennessee R. and Alabama R. systems. (Gr., *στιλβη*, shining.)

236. **N. rubrifrons** (Cope). Olivaceous; sides silvery, dotted. Head 4; depth 4¾. Eye 4; D. 8; A. 10. Scales 5–39–3. L. Champlain to Miss. Valley; abundant. Body less compressed, and the eye smaller and the snout more acute and longer, and the head more slender than in *atherinoides*. (Lat., *ruber*, red; *frons*, forehead.)

237. **N. atherinoides** Rafinesque. Body comparatively elongate, compressed, the back not elevated; head short, blunt; mouth moderate, very oblique, maxillary reaching front of eye; eye 3¼ in head, about equal to snout; fins low, dorsal well behind ventrals; lateral line decurved. Greenish, pale above; sides silvery; a dark vertebral line. Head 4⅖; depth 5½. A. 11. Scales 5–38–3. L. 5. Vt. to Manitoba and Mont., S. in Miss. Valley to Tex.; abundant in lakes and larger rivers; variable. (*Alburnus rubellus* Agassiz; *Alburnellus jaculus* Cope.) (*Atherina*, a genus of fishes + Gr., *εἶδος*, like.)

238. **N. micropteryx** (Cope). Very slender, compressed; head rather pointed; mouth large, oblique, the jaws subequal; eye 3½ in head; lateral line decurved; D. well behind V. Olive; sides silvery. Head 4¼; depth 5½. A. 10. Scales 6–39–2. L. 2¾. Tennessee R., E. to W. N. C., in mountain streams. (Gr., *μικρός*, small; *πτέρυξ*, fin.)

128. LYTHRURUS Jordan (Redfins) (Gr., λύθρον, blood; ὐρά, tail)

Small species, with the body elongate, compressed, the scales small and closely imbricated, the dorsal behind the ventrals, the anal long, 10 to 12 rays, and a black spot at base of dorsal in front. The species and subspecies in this group are ill defined.

L. u. cyanocephalus (Copeland). Body more or less deepened, strongly compressed; head rather pointed; mouth large, rather oblique, the chin somewhat projecting; eye moderate; D. high, about 30 scales before it; lateral line much decurved. A black spot on D. near front, sometimes a dark spot on anal also. ♂ steel-blue, belly and lower fins bright red in spring; dorsal spot strong. Head 4¼; depth 4¼. D. 8; A. 11 to 13. Scales 9–50–3. L. 3½. Minn. to Ohio; abundant. A brilliant little fish. (Gr., κυάνος, blue; κεφαλή, head.)

L. u. umbratilis (Girard). Body often deeper and more compressed than in *cyanocephalus;* snout short and blunt; mouth terminal, wide, oblique, lower jaw included; eye about 4 in head; 30 scales before D. Olivaceous, thickly dusted with black specks; often darker than *cyanocephalus;* body and fins flushed with red in spring; dorsal spot distinct. Head 4; depth (male) 4. A. 9 to 11. Lat. l. 40. L. 3. Missouri to Texas; locally common. (Lat., shady.)

L. lythrurus (Jordan). Slender and less compressed; D. spot large. A. 9 to 11. Ohio and Tennessee basins.

L. ardens (Cope). Like *L. lythrurus*, but A. 11. Roanoke R., Va., representing the *L. lythrurus* of the Alleghenies. (Lat., growing warm.)

L. lirus Jordan. Very slender; eye 3 in head. Color pale, silvery; sides with a band of metallic blue; series of black dots on bases of D. and A.; males with red fins. Head 4⅓; depth 5¼. A. 10. Scales 8–45–4. L. 2½; Tenn. and Ala. (λειρός, pale.)

L. matutinus (Cope). Slender and pale. A. 11. Eye large. Males with snout, chin and upper half of D. red. Carolina pine woods. (Lat., of the dawn.)

129. ERICYMBA Cope (Gr., ἐρι, an intensive particle; κύμβη, cavity)

239. **E. buccata** (Cope). Body rather elongate, little compressed; head long, with broad, prominent snout; mouth small, subinferior, the lower jaw shorter; 15 scales before D.; lateral line straightish; eye 4 in head; suborbitals broad, silvery, crossed by conspicuous translucent or silvery mucous channels, as are also the interopercle and lower jaw. Olivaceous; sides silvery; sexes alike. Head 4; depth 5. D. 8; A. 8. Scales 5–33–3. L. 4. Mich. to Kans. and W. Fla.; abundant in small, clear brooks; remarkably distinguished by the structure of the bones of the head. (Lat., big-jawed.)

130. PHENACOBIUS Cope (Gr., φέναξ, deceptive; βίος, life)

a. Scales rather large, 40 to 52.
b. Breast scaly.

240. **P. teretulus** (Cope). Body slender, subterete; snout thick, decurved; mouth small; eye large, high up, 3½ in head. Yellowish, darker above; a plumbeous lateral band. Head 4⅔; depth 4⅔. D. 8; A. 7. Scales 6–43–5. L. 3½. W. Va. (*Teretulus*, a later name for *Moxostoma*.)

bb. Breast naked.

241. **P. mirabilis** (Girard). Body rather slender, the caudal peduncle short; snout blunt, prominent; eye 4 in head. Pale greenish; a silvery lateral band and a conspicuous black spot at base of C.; sexes similar in appearance. Head 4½; depth 4½. A. 7. Scales 6–50–5. L. 4. Ohio to Colo. and La.; abundant. (Lat., wonderful.)

aa. Scales small, about 60 in lateral line; breast naked.

242. **P. uranops** Cope. Body very slender; tail long; head long, flattish above; snout broad, blunt; mouth inferior, larger than in other species; eye 3½ in head, placed high and behind middle of head; 24 scales before D. Head 4¾; depth 6. A. 7. Scales 7–60–6. L. 4. Tennessee R., in river channels. (Gr., *οὐρανός*, sky; *ὤψ*, eye.)

131. CERATICHTHYS Baird & Girard (*Cliola* Girard) (Gr., *κέρας*, horn; *ἰχθύς*, fish)

243. **C. vigilax** Baird & Girard. Bullhead Minnow. Body rather stout, compressed, with deep tail; head heavy, blunt; snout short, decurved; mouth terminal, slightly oblique; eye 3½ in head; teeth strongly hooked; 28 scales before dorsal, small, crowded. Pale olivaceous, with a plumbeous lateral band, always ending in a black spot at base of C.; a conspicuous black spot on middle of front of D. Head 4¼; depth 4. D. I. 8; A. 7. Scales 8–42–6. L. 3. Ind. to Miss. and Texas; very abundant. Resembles *Hyborhynchus*, but is distinguished by the short intestine, larger mouth, paler coloration, with more definite markings, sharing the generic character of the dorsal spine. (Lat., watchful.)

132. HYBORHYNCHUS (Agassiz) (Gr., *ὕβος*, blunt; *ῥύγχος*, snout)

244. **H. notatus** (Rafinesque). Body rather elongate; head rather long; snout abruptly decurved; mouth horizontal, small; V. not to vent; scales before D. small, crowded, about 23; lateral line always complete. Olivaceous, little silvery; sides bluish; a dusky shade toward base of D.; a black blotch on front of D., wanting in young; head wholly black in spring males, the snout with 14 large tubercles. Head 4; depth 5. D. I, 8; A. 7. Scales 6–45–4. L. 4. Quebec to the Dakotas, Miss., and Kans.; very abundant. Variable. (Lat., marked.)

133. PIMEPHALES Rafinesque (Gr., *πιμελής*, fat; *κεφαλή*, head)

245. **P. promelas** Rafinesque. Body more or less short and deep; head short, blunt, almost globular in adult ♂; V. reaching beyond front of A.; scales before D. about 27; lateral line wanting or more or less imperfect. Olivaceous; a black bar across middle of D. (faint in young); a dark shade along caudal peduncle; adult ♂ dusky, the head jet-black, with large tubercles on snout. Head 4; depth 4. D. I, 7; A. 7. Scales 7–47–4. L. 2½. Maine and Montana to Mexico; abundant in sluggish brooks; very variable. S. W. specimens (subspecies **confertus** Girard) have the lateral line almost complete, the mouth little oblique, and the nuptial tubercles lacking on chin. (Gr., *πρό*, before; *μέλας*, black.)

134. HYBOGNATHUS Agassiz (Gr., *ὑβός*, gibbous or blunt; *γνάθος*, jaw)

246. **H. nuchalis** Agassiz. Silver Minnow. Body rather slender; head rather sharp, the profile evenly curved; mouth narrow, its cleft nearly reaching eye; lower jaw shorter than upper; eye moderate, 4 in head; lateral line decurved; 13 large scales in front of D.; intestine 7 to 10 times length of body. Silvery-green; sides bright silvery, with an underlying plumbeous shade; fins all pale, never red. Head 4½ to 5; depth 4⅓. D. 8; A. 8. Scales 5–38–4. L. 4 to 7. Ohio Valley to Mont. and S. to Miss.; common in large rivers. A very graceful fish. (Lat., of the nape.)

247. **H. regia** Girard. Eastern Silver Minnow. Head deeper and shorter, and eye larger, 3¾ in head. Lake Ontario and N. J., S. to the James and Neuse rivers. Very similar to *H. nuchalis*, which it represents E. (Lat., royal.)

248. **H. hayi** Jordan. Eye larger, jaws stronger, suborbitals narrower, and intestines shorter than in *nuchalis*. Tenn. to Miss. and Ala. (To O. P. Hay, discoverer of the species.)

249. **H. hankinsoni** Hubbs. Head blunter color; darker; fins more rounded than in *nuchalis*, and scales with many weak, instead of a few strong, radii. S. Ont. and Great Lakes region, W. to N. Dak., Colo., and Mo. (Diagnosis by Hubbs.) (To T. L. Hankinson.)

250. **H. placita** Girard. Snout depressed, swollen and blunt; eye very small, usually less than one-sixth length of head. Great Plains. (Lat., placid.)

135. DIONDA Girard (A coined name)

251. **D. nubila** Forbes. Mouth larger than in *Hybognathus* and without prominence at the chin; teeth distinctly hooked; suborbital narrow; maxillary 3½ in head; snout short, not very blunt; eye 3 in head; 12 scales before dorsal. Olivaceous, with plumbeous lateral stripe; no caudal spot; fins in males mostly red. Head 4½; depth 4⅓. Scales 37. L. 2½. Ozark region, N. to Wisc. (Lat., cloudy.)

136. EXOGLOSSUM Rafinesque (Gr., ἔξω, outside; γλῶσσα, tongue)

252. **E. maxillingua** (Le Sueur). Cutlips. Stone Toter. Nigger Chub. Body rather stout; head large, with tumid cheeks, lower jaw included; eye small; intestines short. Color dusky; a blackish bar behind head; a dusky shade at base of C.; fins plain. Head 4; depth 4½. D. 8; A. 7. Scales 8–53–5. L. 6. Vermont to Va.; abundant. A curious fish, remarkably distinguished from all other *Cyprinidae* by the 3-lobed lower jaw. (Lat., *maxilla*, jaw; *lingua*, tongue.)

137. CAMPOSTOMA Agassiz (Gr., καμπή, curve; στόμα, mouth)

253. **C. anomalum** (Rafinesque). Stone Lugger. Stone Roller. Scales crowded forward; intestinal canal 6 to 9 times the total length of the body, its numerous convolutions passing above and around the air bladder, an arrangement found in *Campostoma* alone among all the vertebrates. Brownish, with a brassy luster above; scales mottled; a black vertical bar behind opercle; iris orange; D. and A. each with a dusky crossbar about halfway up, rest of the fin in spring ♂ orange; ♂ in spring with many rounded tubercles on head and body; young mottled brownish, the fins plain. D. 8; A. 7. Scales 7–53–8. Teeth 4–4. L. 4 to 8. W. N. Y., W. to Wyo. and S. to the Rio Grande, in small streams; everywhere abundant; very variable. One of the most curious of American fishes. (Lat., anomalous.)

Order XVI. NEMATOGNATHI

This order contains several families, which agree in having the subopercle wanting, the anterior vertebrae coalesced, provided with auditory ossicles, and the maxillary reduced to the bony core of a long barbel. None of the order has scales, but some are armed with bony plates. Species approaching 1000, mostly of the tropical rivers, especially in Brazil; a few (*Ariidae; Plotosidae*) marine. (Gr., νῆμα, thread; γνάθος, jaw.)

a. Body naked, without bony plates.
b. Barbels 8; top of head smooth; no teeth on vomer; nostrils remote, each with a barbel; fresh-water species. . . . . Ameiuridae, LI.
bb. Barbels 4 or 6; top of head more or less granulated; roof of mouth with teeth; nostrils close together; marine species with the caudal deeply forked. . . Ariidae, LII.

Family LI. AMEIURIDAE (The North American Catfishes)

Body more or less elongate, naked; margin of upper jaw formed by premaxillaries only, the rudimentary maxillaries forming the base of a long barbel; teeth in villiform bands, in jaw only; barbels 8. Dorsal fin short, nearly median; an adipose fin behind dorsal; first ray of dorsal and pectorals de-

veloped as a stout spine; lower pharyngeals separate; air bladder present, large. Species about 30, inhabiting the rivers, lakes, and swamps of America. Many of them are excellent as food, and all are very tenacious of life.

a. Adipose fin with its posterior margin free.
b. Premaxillary band of teeth quadrate, without backward processes.
c. Supraoccipital bone prolonged backward so that its emarginate apex fits closely around the anterior point of the second interspinal, thus forming a continuous bony bridge extending from the head to the dorsal spine. (Silvery species; C. deeply forked.) ICTALURUS, 138.
cc. Supraoccipital bone not reaching the second interspinal, the bony bridge more or less interrupted; caudal truncate or moderately forked.
d. Caudal more or less forked or lunate. . . . . VILLARIUS, 139.
dd. Caudal truncate, scarcely or not at all concave in outline.
e. Eyes normal . . . . . AMEIURUS, 140.
ee. Eyes concealed by the skin (cave fishes). . . . . GRONIAS, 141.
bb. Premaxillary band of teeth, with a lateral backward process on each side; chin very prominent. . . . . OPLADELUS, 142.
aa. Adipose fin keel-like, adnate to the back, more or less joined to caudal fin; a venom pore in axil of pectoral.
f. Premaxillary band of teeth, with a lateral backward process on each side; preopercular spine with retrorse serrae ~~behind~~ before . . . . . NOTURUS, 143.
ff. Premaxillary band of teeth, without lateral backward process.
g. Pectoral spines more or less serrate, especially behind. . . . . RABIDA, 144.
gg. Pectoral spines entire, without serrae anywhere. . . . . SCHILBEODES, 145.

138. ICTALURUS Rafinesque (Gr., ἰχθύς, fish; αἴλουρος, cat)

a. Anal fin very long, its rays 32 to 35, its base nearly ½ of body.

254. **I. furcatus** (Cuvier & Valenciennes). CHUCKLE-HEADED CAT. BLUE CAT. Eye small, wholly before middle of head. Silvery, nearly plain. Head 4¼; depth 5. Miss. Valley N. to Wisc.; not uncommon. Largest of our Catfishes, reaching a very great size, a huge example (150 pounds) being named *Ameiurus ponderosus* Bean. (Lat., forked.)

aa. Anal fin moderate, its rays 24 to ~~30~~ 28, its base 3½ to 4 in body.

255. **I. punctatus** (Rafinesque). CHANNEL CAT. SILVER CAT. Mouth small; barbels long; spines strong, serrate; eye large, not wholly in front of middle of head; supraoccipital smooth. Olivaceous, rarely blackish; sides silvery, almost always with small, round, dark olive spots. Head 4; depth 5. A. ~~35~~ 33. L. 3 feet. Mont. to Vt., Ga., and Mexico; very abundant in flowing streams. A handsome and active fish, the best in the family as food. (Lat., spotted.)

256. **I. anguilla** Evermann & Kendall. EEL CAT. WILLOW CAT. Mouth larger and head heavier than in the others; the supraoccipital broader and finely grooved; snout more blunt. Color pale olivoaceus, without spots. Head 4; depth 4½. D. I, 6; A. 24. Weight 3 to 5 pounds. N. Ill. to Gulf Coast. Flesh firm, excellent. (Lat., eel.)

139. VILLARIUS Rutter (Lat., *villus*,[1] a hair) (*Villarius* Rutter, June 29, 1896; *Haustor* Jordan & Evermann, October 3, 1896)

a. Anal rays 25 to 32; humeral process very short and blunt, usually covered by skin, about ½ length of pectoral spine.

257. V. lacustris (Walbaum). Northern Catfish. Great Lakes Catfish. Body stouter than in the Channel Cat; the head broader, lower, and more depressed; the mouth wider; the caudal less forked; the skin thicker, hiding the bones of the head; head depressed above; supraoccipital above almost reaching second interspinal, the bony bridge broken for a short distance only; anal about as long as head. Slaty bluish, growing darker with age. Head 4; depth 5. D. I, 5 or 6; A. 25 to 32, usually about 28. Great Lakes and N. Abundant in lakes and large rivers, perhaps reaching 50 pounds or more. (*Ameiurus nigricans* Le Sueur.) (Lat., of the lake.)

aa. Anal rays 20 to 23; humeral process very rough, more than half length of pectoral spine.

258. V. catus (Linnaeus). White Cat. Channel Cat of the Potomac. Body stout; head broad, becoming very broad with age. The mouth in old individuals (*Ameiurus lophius* Cope) much wider than in any other catfish; these perhaps represent a distinct species. C. shallow-forked. Olive-bluish; silvery below. L. 24. Pa. to N. C.; very abundant in Potomac R.; introduced into Cal. (*Ameiurus albidus* Le Sueur.) (Low Lat., cat.)

140. AMEIURUS Rafinesque

(Gr., ἀ, not; μέλουρος, curtailed, the tail not notched)

a. Anal fin long, of 24 to 27 rays (counting rudiments), its base more than ½ length of body.

259. A. natalis (Le Sueur). Yellow Cat. Body stout; head short and broad, with wide mouth. Yellowish above. A. 26. L. 15. Great Lakes to Va. and Texas; common in sluggish streams; variable. (Lat., having large *nates* — anal fin.)

260. A. erebennus Jordan. Close to *A. natalis;* C. rounded, the upper rays longest. Color black; lower barbels pale. A. 28. Swamps of N. J. to Fla. (Gr., ἐρεβεννός, black — like Erebus.)

b. Anal fin moderate, of 18 to 22 rays, its base 4 to 5 in body.
c. Pectoral spines long, 2 to 2½ in head; anal rays more than 20.

261. A. nebulosus[2] (Le Sueur). Common Bullhead. Horned Pout.

[1] The young type of the species (*V. dugesi* from Mexico) and probably others have the skin sparsely provided with slender villi.

[2] The Horned Pout are "dull and blundering fellows," fond of the mud, and growing best in weedy ponds and rivers without current. They stay near the bottom, moving slowly about with their barbels widely spread, watching for anything eatable. They will take any kind of bait, from an angleworm to a piece of a tin tomato can, without coquetry, and they seldom fail to swallow the hook. They are very tenacious of life, "opening and shutting their mouths for half an hour after their heads have been cut off." They spawn in spring, and the old fishes lead the young in great schools near the shore, seemingly caring for them as the hen for her chickens. "A bloodthirsty and bullying set of rangers, with ever a lance in rest, and ready to do battle with their nearest neighbor." (*Thoreau.*)

A. rays usually 21 or 22, its base 4 in body; pectoral spines long. Dark yellowish brown, varying from yellowish to black, usually more or less mottled. L. 18. New England, W. to N. D., and S. to Va., and Texas; common; the best known of the smaller Catfishes; introduced into the rivers of Cal. (Lat., clouded.)

cc. Pectoral spines short, 2½ to 3 in head (longer in the young); A. 17 to 19.

d. Body robust, the depth more than ⅕ the length.

262. **A. melas** (Rafinesque). Black Bullhead. Adult very plump; young more slender. A. short and deep, its rays usually 17 to 19, its base nearly 5 in length, its pale rays forming a sharp contrast with the dusky membranes. Color usually blackish. N. Y. to Kans.; generally common; very close to *A. nebulosus*, the anal shorter, the color darker. Represented in Arkansas R. system and S. by subspecies **catulus** Girard. P. spines longer. Body more slender. (Gr., *μέλας*, black.)

dd. Body very slender, the depth less than ⅕ the length.

263. **A. platycephalus** (Girard). A. rays 16 to 20. A dusky blotch on basal part of D. N. C. to Ga. (Gr., *πλατύς*, wide; *κεφαλή*, head.)

141. GRONIAS Cope (Gr., *γρώνη*, cavern)

264. **G. nigrilabris** Cope. Eyes nearly hidden by thick skin; barbels and spines rather short. Upper parts, jaws, and fins black. A. 18. Cave stream, tributary to Conestoga R., E. Pa. A recent descendant probably of *A. melas*, become blind through subterranean life. (Lat., *niger*, black; *labrum*, lip.)

142. OPLADELUS[1] Rafinesque (Gr., *ὅπλον*, armature; *ἄδελος*, not evident — from the small pectoral spine)

(*Leptops* Rafinesque)

265. **O. olivaris** (Rafinesque). Mud Cat. Flathead Cat. Goujon. Body slender; head broad and much depressed, the lower jaw much projecting; barbels short; dorsal spine very weak; pectoral spines strong; anal short; C. scarcely emarginate. Yellowish, much mottled with brown. A. 12 to 15. A very large species, reaching 75 pounds, abundant in sluggish streams, Mich. to Ga. and S. W. A good food fish, of unprepossessing appearance. (Lat., olive.)

143. NOTURUS Rafinesque (Stone Cats) (Gr., *νῶτος*, back; *οὐρά*, tail; "tail over the back," *Rafinesque*)

266. **N. flavus** (Rafinesque). Body elongate; head broad and flat; barbels short; premaxillary band of teeth with lateral backward processes, as in

[1] Of the three names of the same date given Rafinesque to this genus, Gill, the first reviser, chose the second, which he corrects to *Hopladelus*.

Opladelus; adipose fin deeply notched, a keel on back before it; D. spines short; P. spine retrorse-serrate in front, roughish behind. Yellowish brown, nearly uniform. A. 16. L. 12. Ontario to Va., and Mont. to Kans.; not rare in large streams. (Lat., yellow.)

144. **RABIDA** Jordan (Mad Toms) (Lat., *rabidus*, mad)

a. Pectoral spines moderate, the outer serrae weak, not half diameter of spine, the inner stronger, retrorse; body elongate; coloration nearly uniform, the fins darker edged.
b. Pectoral spine short and weak, about 3 to 5 in head in adult.

267. **R. exilis** (Nelson). Head small, rather narrow, depressed; pectoral spine slightly serrate without, with 6 small teeth within (these sometimes obsolete); humeral process obscure; jaws subequal. Head 4; depth 6. A. 14 to 17. L. 4. Wisc. to Kans. (Lat., slim.)

268. **R. gilberti** (Jordan & Evermann). Adipose fin very low, not widely joined to caudal; pectoral spine very short, 4 to 5 in head, outer edge entire, inner serrate at base. Dark brown; base of D. and lower lobe of C. black. A. 15. Roanoke R., Va.; rare, but widely distributed. To Charles Henry Gilbert.

bb. Pectoral spine longer, about 2 ($1\frac{3}{4}$ to $2\frac{1}{4}$) in head.

269. **R. insignis** (Richardson). Head rather broad, flat, and thin, the upper jaw projecting. Head $4\frac{1}{4}$; depth 6. A. 14 to 16. L. 10. Pa. to S. C.; common E. One of the largest species. (Lat., remarkable.)

aa. Pectoral spine very strong, curved, more than half head; its posterior serrae recurved, their length about equal to diameter of spine; the anterior serrae small.
c. Color much variegated; adipose fin deeply notched, but not separated from C.

270. **R. miurus** (Jordan). Mad Tom. Head not specially depressed; eye $4\frac{1}{2}$ in head; humeral process moderate; pectoral spine $1\frac{1}{3}$ to $1\frac{5}{6}$ in head. Grayish; top of head, tip of dorsal, middle of adipose fin, and caudal black; the body with 4 black cross-blotches. Head $3\frac{2}{3}$. A. 13 to 15. L. 5. N. C. to Minn. and La.; abundant. (Gr., μείουρος, curtailed.)

cc. Color nearly plain brownish, everywhere above covered with fine small dots; adipose fin almost or quite free from caudal.

271. **R. eleutherus** (Jordan). Head broad, flat, depressed, the form very much as in *Opladelus;* humeral process obscure; eye $5\frac{1}{2}$ in head; pectoral spine $1\frac{3}{4}$ to 2 in head. Head $3\frac{4}{5}$. A. 13. L. 4. Ohio and Tenn. to Okla.; the original type taken from the mouth of a water snake in French Broad R. (Gr., ἐλεύθερος, free.)

145. **SCHILBEODES**[1] Bleeker (*Schilbe*, an Asiatic genus)

aaa. Pectoral spine weak, and without serrae; adipose fin almost even-edged with caudal.

[1] These little fishes abound in small brooks among logs and weeds. The wounds produced by the sting of their sharp pectoral spines are excessively painful. In the axil is usually a pore, apparently the opening of a duct from a poison gland.

272. **S. nocturnus** (Jordan & Gilbert). Head broad, little depressed; barbel short; pectoral spine 2 in head, nearly entire on outer margin, rough at base within; adipose fin high, joined to caudal. Dark brown, coarsely dotted. A. 16. Weedy streams, from the Wabash to the Arkansas. (Lat., of the night.)

273. S. **gyrinus** (Mitchill.) Head short, broad, and deep; pectoral spine entire, grooved behind, 2 in head; jaws subequal; adipose fin continuous with caudal. Yellowish brown, not blotched, but with a narrow black lateral streak, sometimes with 2 above it. A. 15 or 16. L. 5. Hudson R. to S. Dak., and S. to La.; common N. (Gr., γυρῖνος, tadpole.)

Family LII. ARIIDAE (Sea Catfish)

Marine Catfishes; the skin naked; the head usually with a bony casque; skull with a fontanelle; mouth moderate, the lower jaw shorter; barbels 4 or 6, none at the posterior nostril; teeth villiform or granular, one or more patches on vomer or palatines; caudal deeply forked; anal short. Species numerous on sandy shores of tropical America and Asia; never about coral reefs; little valued as food. Color bluish above; sides silvery.

a. Teeth all villiform.
  b. Lower jaw with 2 barbels; maxillary barbel band-like; dorsal and pectoral spines ending in long striated filaments. . . . . Bagre, 146.
  b. Lower jaw with 4 barbels; spines not filamentous.
    cc. Teeth all pointed; bands of palatine teeth without backward processes; interorbital area smooth; bones of head not hidden in soft skin; vomerine and palatine patches not confluent; fontanelle produced backward as a groove. . Galeichthys, 147.

146. BAGRE (Cuvier) Oken (*Ailurichthys* Baird; *Felichthys* Swainson)

(*Bagre*, a Spanish name for Catfishes)

274. **B. marina** (Mitchill). Gaff-topsail Cat. Head short and broad; maxillary barbels reaching end of P. spine; P. filament reaching vent; D. filament to adipose fin; upper lobe of C. longer; palatine teeth in a nearly continuous band. Dusky bluish. Head $4\frac{1}{4}$. D. I, 7; A. 23. L. 30. N. Y. to Texas; common S.; not entering streams. (Lat., marine.)

147. GALEICHTHYS Cuvier & Valenciennes. (Gr., γαλῆ, weasel; ἰχθύς, fish)

a. Bones of head above, not hidden by thick skin. (*Hexanematichthys* Bleeker).

275. **G. felis** (Linnaeus). Sea Catfish. Interorbital area flattish and smooth, without ridges or granulations; fins not low, the spines more than half length of head; vomerine teeth in a small patch; palatine teeth in a larger one, on each side, the 4 patches separate; fontanelle prolonged backward as a narrow groove; occipital process long, about $\frac{1}{3}$ head, convex at tip, with a median keel; gill membranes not meeting at an angle; maxillary

barbel nearly as long as head. L. 24. N. Y. to Texas; common S.; the northernmost species of marine Catfish. Many species of this and other genera occur in the West Indies and on both coasts of Mexico. (Lat., cat.)

Order XVII. INIOMI (Gr., *ἰνίον*, nape; *ὦμος*, shoulder)

The members of this group have much in common with the *Isospondyli*. In all the species, however, the premaxillaries, as in perch-like fishes, form the margin of the upper jaw, excluding the toothless maxillaries from the edge; connection of shoulder girdle with the skull imperfect. Most of the species belong to the deep-sea fauna, being black in color and with luminous glands. Nearly all have the adipose fin. Among the many families, only two may be here noted.

a. Deep-sea fishes; black and with numerous round luminous spots. Myctophidae, LIII.
aa. Shore fishes; pale in color and without luminous spots. . . . . Synodontidae, LIV.

Family LIII. MYCTOPHIDAE (The Lantern Fishes)

Body oblong; mouth moderate, the jaws not prolonged; teeth villiform; scales large, on head as well as on body. Small, round, luminous glands regularly placed; often larger glands on head and on caudal peduncle. Species numerous, all of small size; often rising from deep water after storms.

a. Dorsal ending little, if any, before front of anal; caudal photophores always 2; no luminous glands on head; scales cycloid; snout short. . . . . Myctophum, 148.

148. MYCTOPHUM Rafinesque (Lantern Fishes) (Gr., *νύξ*, night; *φώς*, light) [1]

276. **M. punctatum** Rafinesque. The commonest species, on both sides of the Atlantic, in deep water; sometimes driven to the surface by storms. (Lat., spotted.)

Family LIV. SYNODONTIDAE (The Lizard Fishes)

Body elongate, subterete, covered with cycloid scales; head depressed; mouth very wide, its margin formed by the slender premaxillaries, the maxillaries closely joined to them; teeth usually strong, cardiform, the large ones often depressible; no barbels; sides of head usually scaly; adipose fin usually present; D. short, median; C. forked; air bladder small or wanting; skeleton weakly ossified; no luminous spots; ovaries with an oviduct. Species mostly of deep waters in warm regions.

a. Teeth not barbed; maxillary not dilated behind; teeth on palatines in a single band on each side; shore fishes.
b. Head depressed, with rather long snout. . . . . Synodus, 149.
bb. Head compressed, with very short snout. . . . . Trachinocephalus, 150.

[1] This is the usual derivation of *Myctophum* (*Nyctophos*), but Rafinesque did not know that these spots were luminous.

149. SYNODUS (Gronow) Bloch & Schneider (Gr., *συνόδους*, ancient name of some fish)

277. **S. foetens** (Linnaeus). Lizard Fish. Snakefish. Dorsal slightly higher than long; snout longer than broad, lower jaw included; scales of cheeks in 7 rows; ventrals $2\frac{1}{3}$ in head. Olivaceous; back mottled; top of head vermiculated; V. and mouth yellow. Head $4\frac{1}{4}$; depth 6 or 7. D. 11; A. 11. Scales 4–64–6. L. 12. Cape Cod to Fla., on sandy coasts; common S. (Lat., ill-scented.)

278. **S. intermedius** (Agassiz). Sand-Diver. Dorsal as high as long; snout broader than long; jaws subequal; scales on cheeks in 4 to 6 rows; ventrals $1\frac{1}{6}$ in head. Grayish, abruptly paler below; back and sides with 8 dark crossbands; a large black blotch on shoulder girdle. Head 4; depth 8. D. 11; A. 11. Scales 4–48–7. N. C. to Brazil. (Lat., intermediate.)

150. TRACHINOCEPHALUS Gill

(*Trachinus*, a genus of fishes + Gr., *κεφαλή*, head)

279. **T. myops** (Forster). Snakefish. Lagarto. Head $3\frac{2}{3}$; depth about 5. D. 11; A. 14 or 15; scales 4–58–7. Vertebrae 58; caeca 25. Snout very short, shorter than eye, lower jaw projecting; top of head rough; interorbital space concave. Pectoral very short, nearly 2 in head, scarcely reaching beyond the front of the very long ventrals, which are as long as head and reach vent ; A. very large, its base $1\frac{1}{4}$ in head, $\frac{1}{4}$ longer than the dorsal. Light brown. Tropical seas, rare N. on our coast to Woods Hole, Mass. (Gr., *μύωψ*, short-sighted.)

Order XVIII. HAPLOMI (The Pike-like Fishes)

This order differs from the *Isospondyli*, chiefly in the simpler structure of the shoulder girdle, which lacks the precoracoid arch. There is never an adipose dorsal; the dorsal is posterior in position, and the head is depressed and more or less scaly. The premaxillary, as in the *Isospondyli*, is short, the maxillary forming the border of the upper jaw, as in the *Salmonidae*. Pseudobranchiae wanting or glandular. Fresh-water species. (Gr., *ἁπλόος*, simple; *ὦμος*, shoulder.)

a. Snout short; mouth small, with villiform teeth. . . . . Umbridae, LV.
aa. Snout long, depressed; mouth very large, with sharp canines. . . . Esocidae, LVI.

Family LV. UMBRIDAE (The Mud Minnows)

Body formed as in *Fundulus;* head large, flattened above; mouth moderate, the premaxillaries not protractile, the maxillaries forming lateral margin of upper jaw; jaws, vomer, and palatines with villiform teeth; gill openings wide; gill rakers obsolete; scales cycloid on head and body; no lateral line; C.

rounded; P. narrow; intestinal canal without caeca; air bladder simple. Oviparous; sexes similar. Carnivorous fishes, living in mud in the clear waters of sluggish streams and ponds in cool regions; extremely tenacious of life. One genus with 3 species, *Umbra crameri* of Austria, besides the 2 American forms.

"A locality which, with the water perfectly clear, will appear destitute of fish, will perhaps yield a number of Mud Fish on stirring up the mud at the bottom and drawing a seine through it. Ditches in the prairies of Wisconsin, or mere bog holes, apparently affording lodgment to nothing beyond tadpoles, may thus be found filled with Mud Minnows." (*Baird.*)

151. UMBRA (Kramer) Müller (*Melanura* Agassiz) (Lat., shade)

280. **U. limi** (Kirtland). Mud Minnow. Ventrals slightly before D.; A. much smaller than D. Dull olive-green, with about 14 narrow pale bars, faint in young; black caudal bar faint; lower jaw pale. Great Lakes region, W. to Iowa; very common in cool, weedy brooks and swamps. (Lat., of the mud.)

281. **U. pygmaea** (De Kay). Eastern Mud Minnow. Very similar, but differently colored. Greenish, with narrow dark and light streaks along rows of scales; no bars, except a dark bar across base of caudal which is very evident; lower jaw black. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. B. 6; D. 14; A. 9. Scales 35–15. L. 4. N. C. to Conn., in swamps. (Gr., πυγμάια, dwarf.)

Family LVI. ESOCIDAE (The Pikes)

Body elongate, somewhat compressed, with rather small cycloid scales; lateral line present, more or less imperfect; head long, the snout much prolonged and depressed; mouth very large, the lower jaw longer; upper jaw not protractile, most of its edge formed by the maxillaries; premaxillaries, vomer, and palatines with bands of more or less movable, cardiform teeth; lower jaw with strong, unequal teeth; tongue with small teeth; head naked above, scaly on sides; gill rakers tubercular; B. 12 to 20; D. opposite A., as in all *Haplomi;* C. emarginate; P. small; intestinal canal simple, with caeca; air bladder present. One genus, with 5 species; one in the fresh waters of both continents, the others all American. All are noted for their voracity, " mere machines for the assimilation of other organisms." The flesh is white, flaky, and excellent. The Pike is a " solemn, stately, ruminant fish, lurking under the shadow of a lily pad at noon, with still, circumspect, voracious eye, motionless as a jewel set in water, or moving slowly along to take up its position; darting from time to time at such unlucky fish or frog or insect as comes within its range and swallowing it at a gulp. Sometimes a striped snake, bound for greener meadows across the stream, ends its undulatory progress in the same receptacle." (*Thoreau.*)

152. ESOX (Artedi) Linnaeus (An old name of the Pike) (*Lucius* Rafinesque)

a. Cheeks and opercles entirely scaly. (*Kenoza* Jordan & Evermann.)

b. Branchiostegals 12 (11 to 13); scales 105 to 108; D. 11 or 12; A. 11 or 12; snout short, the middle of eye nearer tip of lower jaw than edge of opercle; species of small size.

282. **E. americanus** Gmelin. Head short; snout $2\frac{1}{2}$ in head; eye $2\frac{2}{3}$ in snout. Dark green; sides with about 20 distinct curved dusky bars; fins plain. Head $3\frac{4}{7}$; depth $5\frac{1}{2}$. L. 12. Mass. to Fla., in coastwise streams.

283. **E. vermiculatus** Le Sueur. Mud Pickerel. Little Pickerel. Head longer; snout $2\frac{1}{5}$ in head; eye $2\frac{1}{2}$ in snout. Olive-green; sides with many darker curved streaks, usually distinct and more or less reticulate; fins mostly plain. Head $3\frac{1}{4}$; depth $5\frac{1}{2}$. L. 12. Miss. Valley, etc.; very abundant in small streams and bayous. May be a subspecies of *americanus*. (Lat., having marks like worm tracks.)

bb. Branchiostegals 14 to 16; D. 14 (developed rays); A. 13; scales about 125; snout long, the middle of eye midway between chin and edge of opercle.

284. **E. niger** Le Sueur. Common Pickerel. Chain Pickerel. Pickerel. Head long; snout $2\frac{1}{3}$ in head; eye $3\frac{1}{2}$ in snout. Greenish, with numerous narrow dark lines and streaks, mostly horizontal and more or less reticulated; fins plain. Head $3\frac{1}{2}$; depth 5. L. 30. Me. to Ala.; abundant in coastwise streams; not W. of Alleghenies. (*E. reticulatus* Le Sueur, name preoccupied; *E. tridecimlineatus* Mitchill, a patriotic name of later date than *E. niger*.) (Lat., black.)

aa. Cheeks entirely scaly; lower half of opercles bare; B. 14; D. 16 or 17; A. 13 or 14; scales about 123. (*Esox.*)

285. **E. lucius** Linnaeus. Pike. Pickerel. Great Northern Pike. Head long; snout $2\frac{2}{3}$ in head; eye 3 in snout, placed as in the preceding. Grayish, with many round whitish spots; the young with pale bars; D., A., and C. spotted with black; a white horizontal streak bounding naked part of opercle. Head $3\frac{1}{3}$; depth 5. L. 30 to 50. N. Am., from L. Champlain to N. Ind. and N. W. to N. Alaska; abundant N. (*E. estor* Le Sueur, the American Pike, may prove to be different.) (Low Lat., pike, or pike-like fish.)

aaa. Cheeks as well as opercles scaleless on the lower part; B. 17 to 19; D. 17; A. 15; scales about 150. (*Mascalongus* Jordan.)

286. **E. masquinongy** [1] (Mitchill). Muskallunge. Maskinongy. Head large; snout $2\frac{1}{3}$ in head; eye 4 to 5 in snout. Dark gray, sometimes nearly immaculate in the upper Mississippi (subspecies **immaculatus** Garrard), usually with rather small round black spots on a paler ground; fins spotted with black. Head $3\frac{2}{3}$; depth 6. L. 8 feet. Great Lakes region and N. W. A magnificent fish, one of the largest in fresh waters. "A long, slim, strong, and swift fish, in every way fitted for the life it leads, that of a dauntless

[1] From *mas*, ugly, and *kinononge* (Kenoza), fish, in the Ojibway dialect, perverted to **Muskallunge**, wrongly derived from French *masquallongée*.

marauder." (*Hallock.*) (The Indian name.) The typical form in the Great Lakes. Represented S. E. by subspecies **ohioensis** Kirtland, The Chautauqua Muskallunge. Very similar to *masquinongy*, but with narrow black crossbars, which break up with age into diffuse dark blotches. Ohio Valley, N. to Chautauqua L.

Series PHYSOCLISTI

We now begin the division of fishes in which the air bladder in the adult loses all connection with the alimentary canal. This character in itself seems of slight importance, but it is associated with gradual modifications in other respects, of such character that the typical Physoclist is quite unlike the average Physostome. Most of the Physoclists have spines in some of the fins; the skeleton is more specialized; the ventral fins are normally thoracic, each with a spine and 5 rays; and the pectorals are inserted high. But there are many exceptions to each of these characters. We commence the series with the *Cyprinodontes* and other forms most closely related to the soft-rayed fishes. (Gr., *φύσος*, air bladder; *κλειστός*, closed.)

Ross H. Arnett, Jr.

Order XIX. CYPRINODONTES (*Microcyprini*)

The Killifishes

Small fishes having the margin of the upper jaw formed by premaxillaries; head usually scaly above and on sides; teeth variously formed, always small; dorsal fin single, posteriorly inserted; ventrals, if present, abdominal; no fin spines. Fishes of shallow estuaries or of fresh waters, found in all warm regions. (Gr., *κύπρινος*, carp; *ὀδούς*, tooth.)

a. Vent normal; eyes well developed; head scaly.
b. Anal fin in the male not modified; oviparous. . . . . Cyprinodontidae, LVII.
bb. Anal fin in the male inserted forward and modified into an intromittent organ; viviparous. . . . . Poeciliidae, LVIII.
aa. Vent at the throat; eyes small or rudimentary; head naked. . . Amblyopsidae, LIX.

Family LVII. CYPRINODONTIDAE (The Killifishes)

Body oblong, depressed in front, more or less compressed behind, covered with adherent cycloid scales; no lateral line; head scaly; mouth small, terminal, extremely protractile, the edge of upper jaw formed by premaxillaries; teeth fixed, pointed, sometimes trifid; gill membranes somewhat connected, free from isthmus; B. 4 to 6. D. single, inserted posteriorly, rarely preceded by a spine; C. not forked; stomach siphonal, without pyloric caeca; sexes unlike; all species oviparous. Species numerous; in fresh and brackish waters of most warm regions. Most of them are small in size. The species are carnivorous; some of them surface swimmers.

a. Intestinal canal short, but little convoluted; dentary bones firmly united; teeth fixed; carnivorous species.
b. Teeth in a single series, incisor-like, trifid; dorsal of 10 or 11 rays, the first ray small; gill openings restricted above; body stout and deep. (*Cyprinodontinae.*)
CYPRINODON, 153.
bb. Teeth pointed; ventrals present; air bladder present. (*Fundulinae.*)
c. Teeth in more than one series.
d. Dorsal relatively large, its rays mostly 12 to 18; bottom fishes.
e. Gill opening free to well above pectoral base; intestines little convoluted.
f. Dorsal inserted before front of anal; color plain, olive and black.
FUNDULUS, 154.
ff. Dorsal inserted over front of anal; colors brilliant, largely orange.
XENISMA, 155.
ee. Gill opening free only to opposite upper edge of pectoral base; intestines considerably convoluted . . . . . PLANCTERUS, 156.
dd. Dorsal smaller, posteriorly placed, its rays 7 to 10; surface swimmers; size small.
ZYGONECTES, 157.
cc. Teeth in one series; D. inserted before A.; D. and A. short, of 10 to 12 rays; small species; plainly colored. . . . . LUCANIA, 158.

153. CYPRINODON Lacépède (Gr., *κυπρῖνος*, carp; *ὀδών*, tooth)

287. **C. variegatus** Lacépède. PURSY MINNOW. SHEEPSHEAD MINNOW. Body short, deep, compressed; humeral scale 4 times size of others. ♂ steel-blue, more or less copper-red below, C. with black bar at base and tip; ♀ olivaceous, sides silvery, with irregular dark cross-streaks, a dark spot on D. behind. Head 3; depth in adult about 2. D. 10; A. 10. Scales 25–12. L. 2 to 4, southern specimens being larger and more brightly colored. Cape Cod to Texas, in brackish waters; common. (Lat., variegated.)

154. FUNDULUS[1] Lacépède (Lat., *fundus*, bottom — they often bury in the mud)

a. Scales comparatively large, about 36 in a lengthwise series, 13 in a cross series.
b. ♂ with dark crossbars and a black dorsal spot; ♀ with longitudinal black bands. (*Galasaccus* Fowler.)

288. **F. majalis** (Walbaum). KILLIFISH. MAYFISH. Head long, with long snout; eye moderate; D. moderate; A. very high in ♂. ♂ olivaceous, brassy on sides, with about 12 bars of color of back, a black spot on D., lower fins sometimes yellow, top of head black; ♀ much larger than ♂, paler, a black band on level of eye, with 2 shorter bands below it, 1 or 2 black crossbars at base of C. Head $3\frac{3}{4}$; depth 4. D. 12; A. 10. Scales 36–13. L. 6. Cape Cod to Fla.; the largest of the family; common in shallow bays. (Lat., pertaining to May.)

bb. ♂ with silvery spots and bars, with ocellus on D.; ♀ nearly plain olivaceous; young with black crossbars; oviduct in ♀ extended far out on A. fin. (*Fundulus.*)

289. **F. heteroclitus** (Linnaeus). COMMON KILLIFISH. MUMMICHOG. COBBLER. MUD DABBLER. Body robust; head short, broad; eye about equal to

[1] The groups here called *Zygonectes* and *Xenisma* may prove inseparable from *Fundulus*; *Planterus* is better defined.

snout. ♂ dark green, sometimes orange below, sides with scattered yellowish spots, sometimes running into silvery crossbars, vertical fins dark, with pale spots, usually a black spot on D.; young ♂ with 9 or 10 silvery bars; young ♀ with 9 or 10 black bars; adult ♀ nearly plain. Head $3\frac{2}{3}$; depth $3\frac{1}{2}$. D. 11; A. 10. Scales 35–12. L. 2 to 5. Gulf of St. Lawrence to Mexico; everywhere common along shore, in shallow water. Three or more subspecies are usually recognized, but are not well defined. (Gr., ἕτερος, different; κλιτύς, slope.)

bbb. ♂ with fewer silvery spots; ♀ banded or spotted, with D. ocellus; young with black crossbars; oviduct not extended far out on A. fin.

290. **F. ocellaris** Jordan & Gilbert. Much like *heteroclitus*, but differing as indicated above. Head 3 to $3\frac{1}{3}$; depth 4; eye 4. D. 11; A. 10. Scales 35–15. L. 3. N. C. to La. (Lat., eyed.)

aa. Scales moderate, 43 to 50 in longitudinal series.
d. D. inserted before A.; sides with many dark crossbands. (*Menona* Jordan & Evermann.)

291. **F. diaphanus** (Le Sueur). Body rather slender; head slender, flat above; fins low. Olivaceous; sides silvery, with 15 to 25 narrow dark crossbands; fins nearly plain. In adult ♂ silvery crossbands replace the darker. Western specimens (subspecies **menona** Jordan & Copeland, Ohio W.) have the bands very distinct and somewhat irregular, the back always spotted. Eastern specimens (the typical subspecies) have the back plain, the bands faint and regular. Head $3\frac{1}{2}$ to 4; depth 5. D. 13; A. 11. Scales 46–12. L. 4. Great Lakes and tributaries E. to Me., S. to N. Ind., W. to Colo., in clear streams and lakes, descending to river mouths. (Lat., diaphanous.)

aaa. Scales about 38; fresh-water transitional species, with smaller fins, leading toward *Zygonectes*. (*Gambusinus* Jordan & Evermann.)

292. **F. rathbuni** Jordan & Meek. A transitional form. D. inserted scarcely behind A.; fins all low and small. Pale green, with dark spots and edgings. D. 11; A. 11. Scales 38. Streams of Va. and E. N. C.; not descending to the sea. (Named for Richard Rathbun.)

155. XENISMA Jordan (Gr., ξενίσμα, a surprise)

293. **X. catenatum** (Storer). Studfish. Body long, compressed; head broad. Color greenish; ♂ with an orange spot on each scale; ♀ with smaller brown spots, these forming continuous stripes. Head 4; depth $4\frac{1}{2}$. D. 14; A. 15. L. 7. Mountain streams, E. Tenn. and Ozark region. Very pretty. In Alabama R. is a still brighter species (**X. stelliferum** Jordan), with scattered orange spots. (Lat., with chain-like lines.)

156. PLANCTERUS Garman (Lat., rustling)

294. **P. kansae** Garman. Body slender; head long; fins low. Greenish; sides silvery-white, with 14 to 18 crossbars of the color of the back; fins plain.

Head $3\frac{2}{3}$; depth $4\frac{2}{3}$. D. 14; A. 13. Scales 60–21. L. 3. Arkansas and Red River systems. (Named for Kansas.)

157. ZYGONECTES Agassiz (Gr., *ζυγόν*, yoke; *νήκτης*, swimmer — they being said to swim in pairs)

a. Sides with a broad blue-black lateral band; vertical fins dotted.

295. **Z. notatus** (Rafinesque). Top Minnow. Body rather elongate; head low; snout long; eye 3 in head; outer teeth enlarged; fins moderate. Lateral band darkest and serrated in the males; back dotted; a translucent spot on top of head. Head 4; depth $4\frac{1}{2}$. D. 9; A. 11. Scales 34–11. L. 3. Mich. to Ala. and Texas; abundant in quiet waters. (*Fundulus olivaceus* Storer.) (Lat., noted; i.e., spotted.)

aa. Sides with 10 to 12 dark vertical bars, but without longitudinal stripes; D. in ♂ with a large black ocellus, edged before with white, behind by yellow.

296. **Z. luciae** (Baird). Body rather elongate; green-yellow below. Head about $3\frac{1}{2}$; depth about 4. D. 8; A. 9. Scales undescribed, probably about 35. L. 1. Rare, N. J. to N. C., near the coast. (Named for Lucy Baird, daughter of Professor Baird.)

aaa. Sides with about 10 stripes of orange-brown following the rows of scales, a spot on each; ♂ with the lines interrupted and with 9 dark crossbars; a black blotch below eye.

297. **Z. dispar** Agassiz. Body deep, compressed; head short, very broad; fins low; D. much smaller than A. Bluish olive; lateral stripes wavy. Head $3\frac{3}{4}$; depth $3\frac{1}{2}$. D. 7; A. 9. Scales 35–10. L. $2\frac{1}{2}$. Lakes and ponds, Mich. to Ark. (Lat., dissimilar.)

297*a*. **Z. nottii** (Agassiz). Similar to *Z. dispar*, but body much more slender (depth $4\frac{1}{2}$). S. E. states, N. to N. C. (Named for a Mr. Nott.)

aaaa. Sides plain olivaceous, without spots or lines.

298. **Z. sciadicus** (Cope). Body short, deep; fins small. Head $3\frac{1}{4}$; depth about $3\frac{1}{4}$. D. 10; A. 12. Scales 39–13. L. 2. Colo. to Okla., in Missouri and Neosho R. systems. (Lat., knowable.)

158. LUCANIA Girard (A name of euphony without meaning)

299. **L. parva** (Baird & Girard). Rainwater Fish. Body rather deep. ♂ dark olive, D. dusky orange with black and orange ocellus at base in front, other fins chiefly orange; ♀ larger, the fins plain. Head $3\frac{1}{2}$; depth about 3, D. 10; A. 10. Scales 26–8. L. 2. L. I. to Key West, in tide pools, etc. (Lat., small.)

Family LVIII. POECILIIDAE (The Mosquito Fishes)

All members of this family have the anal fin in the male placed forward and modified into an intromittent organ and all are viviparous. All are American, and many are valued as aquarium fishes.

a. Mouth of moderate size, with pointed teeth immovably joined to the jaws. Rays 4 and 5 of the A. fin in the breeding ♂ with retrorse hooks. . . . . Gambusia, 159.

aa. Mouth small, with lateral gape little developed; teeth somewhat compressed, movable, attached to the weak jaws; A. fin of ♂ without hooks. . . . . Heterandria, 160.

159. GAMBUSIA Poey

(From the Cuban word *Gambusino*, which signifies *nothing*, with the idea of a joke or farce. Thus people say that one "fishes for Gambusinos," when he catches nothing. *Poey.*)

300. **G. patruelis** (Baird & Girard). Mosquito Fish. Body plump; tail rather long; snout broad; eye 2½ to 3, longer than snout. Olivaceous; a blackish area below eye, usually distinct; D. and C. mostly with dark cross-streaks of dots; usually a dusky blotch on sides in ripe females (the dusky interior showing through the translucent skin); young plain yellowish brown. Head 3⅔; depth 3¼ to 4. D. 7; A. 10. Scales 30–9. L. of ♀ 2½; of ♂ 1. Very abundant in all lowland waters, ditches, and gutters of the lower Mississippi, from S. Ill. and Mo. to Texas. The males are scarce and very small, the anal process about as long as head. The young are born in the summer (May to October), at the length of about ⅓ inch. There are about 8 in a brood; about 6 females to 1 male. They sometimes breed at the age of 4 months. The females are easily mistaken for *Zygonectes* and have been repeatedly described as such. A most useful devourer of mosquitoes, now successfully introduced into California, Burma, Siam, India, Hawaii, Tahiti, Formosa, and the Philippines. One individual has been known to devour 165 mosquito larvae in a day. Extremely hardy, readily reared in pools in regions free from thick ice. In winter, they hibernate in mud or weeds. (Lat., cousin.)

301. **G. holbrookii** Girard. The mosquito fish of the East Coast (N. J. to Fla.), now regarded as a distinct species, lately introduced into Spain, Italy, Macedonia, Greece, and Jerusalem. According to Garman it has one more ray in the dorsal; the eye is smaller, shorter than snout, 3½ in head. Markings on head, body, and fins usually more distinct; a silvery spot on top of head, as in *G. patruelis*, and sometimes a faint lateral silvery streak. Head 4; depth 3⅘. D. 8; A. 10 or 11. Scales 30–9. Vert. 14 + 18. L. 2½. A distinct species, *Gambusia affinis* Baird & Girard, occurs in S. W. Texas, and several others in Mexico and Cuba. They are now classified in several subgenera, based on the form of the anal fin, which is modified as an intromittent organ. (To Holbrook.)

160. **HETERANDRIA** Agassiz (Gr., ἕτερος, different; ἀνήρ, male)

302. **H. formosa** Agassiz. Top Minnow. This is one of the smallest of all known fishes, the males being mature at ½ to ¾ inch, and the females not attaining much more than an inch in length. A black band along sides, crossed by black bars; a black spot on both D. and A. Fla. to N. C. (Lat., comely.)

Family LIX. **AMBLYOPSIDAE** (The Cave Fishes)

Body elongate, with long, depressed head; mouth large, the lower jaw projecting; premaxillaries scarcely protractile, forming whole edge of upper jaw; teeth villiform; eyes sometimes rudimentary and concealed under the skin; head naked, usually with papillary ridges; body with small cycloid scales, irregularly arranged; no lateral line; D. far back, opposite A.; C. rounded; V. small or wanting; vent at the throat, as in *Aphredoderus*; gill membranes joined to isthmus; stomach caecal, with pyloric appendages; some (and probably all) viviparous. Species few; all American. Fishes of small size, living in subterranean streams and ditches of the central and southern U. S., doubtless remnants of an ancient fauna.

a. Eyes well developed; no tactile papillae; no ventrals; pyloric caeca 2; body more or less colored. Swamp fishes. . . . . Chologaster, 161.

aa. Eyes imperfectly developed; sides with tactile papillae; no ventrals; pyloric caeca 2; body with color. Cave fishes, not yet quite blind. . . . . Forbesella, 162.

aaa. Eyes very rudimentary, concealed under the skin; sides with tactile papillae; 1 pyloric caecum; body colorless. Cave fishes.

b. Ventrals entirely wanting; size small.

c. Scleral cartilage wanting; eye without pigment. Caves of Ky. and Tenn. Typhlichthys, 163.

cc. Scleral cartilage present; eye with pigment, minute. Caves of Mo. Troglichthys, 164.

bb. Ventrals present, small; eye blind, size larger. . . . . Amblyopsis, 165.

161. **CHOLOGASTER** Agassiz (Rice-field Minnows)

(Gr., χολός, maimed; γαστήρ, belly — the ventrals being wanting)

303. **C. cornutus** Agassiz. Rice Fish. Mouth moderate, oblique, the maxillary not reaching eye; nostrils with short flaps ("horns"); pectoral small, nearly reaching dorsal. Yellowish brown, dark above; sides with 3 dark longitudinal stripes, becoming dots on the tail; middle rays of caudal dark, fin otherwise uncolored. Head 3⅕; depth 4½. D. 8 or 9; A. 8 or 9. L. 2¼. Ditches in rice fields, S. C. and Ga.; probably varying into its more northern analogue. (Lat., horned.)

304. **C. avitus** L. Jordan & Jenkins. Fish of the Dismal Swamp. Mouth moderate, oblique, the maxillary not quite reaching eye; pectoral 1½ in head, 1⅘ in distance to dorsal; caudal pointed, as long as head. Dark brown, the belly abruptly white, everywhere sprinkled with black dots; sides with 3 nar-

row, sharply defined black streaks, the middle one broadest, extending across snout and eyes, the lower breaking into dots behind; a large black blotch at base of caudal; behind this a white blotch, sometimes covering half of fin, sometimes reduced to 2 small pale spots; posterior half of caudal jet-black; dorsal white, spotted or edged with black. Head $3\frac{2}{3}$; depth $5\frac{1}{2}$ to $6\frac{1}{2}$. D. 8 or 9; A. 8 or 9. Scales 68. L. $1\frac{4}{5}$. L. Drummond and ditches about the Dismal Swamp; abundant. This is apparently near the primitive type of the Blindfish. It is perhaps not separable from *C. cornutus*, being a little more slender, more sharply and somewhat differently colored. (Lat., ancestral.)

162. FORBESELLA Jordan & Evermann

(Named for Stephen Alfred Forbes, of the Illinois Natural History Survey)

This genus contains transitional species connecting *Chologaster* with *Typhlichthys*.

305. **F. papillifera** (Forbes). Body with tactile papillary ridges; eye small, 6 in head, above and well behind maxillary; P. reaching halfway to D. Yellowish brown, dark above; sides with 3 dark streaks, the middle streak pale behind head; C. dark, with cross-rows of white specks. Head $3\frac{1}{3}$. L. 1. Cave springs, Union Co. and Pope Co., S. Ill. (Type of the genus.) (Lat., bearing papillae.)

306. **F. agassizii** (Putnam). Eye large; P. a little more than halfway to D. Color plain, without stripes; uniform light brown; fins speckled. Head 4; depth 4. D. 9; A. 9. L. $1\frac{1}{4}$. Subterranean streams in Tenn. and Ky. (Papillae not described, but the species seems nearer *Forbesella* than *Chologaster*.) (Named for Louis Agassiz.)

163. TYPHLICHTHYS Girard (Gr., τυφλός, blind; ἰχθύς, fish)

307. **T. subterraneus** Girard. Lesser Blindfish. General character of *Amblyopsis spelaeus*, but the head rather blunter and broader forwards, the mouth smaller. Width of head 5; length of head 3 to $3\frac{2}{5}$; orbital fat mass elongate, inconspicuous in life, not projecting; cheeks little swollen; eye averaging .16 mm. in diameter; first A. ray about equidistant between vent and base of middle caudal ray. D. 8; A. 8; P. 12. L. 2. Caves and wells in Ky., Tenn., and Ala.; common. (Lat., subterranean.)

308. **T. wyandotte** Eigenmann. Width of head contained more than 6 times in length to base of C.; length of head $3\frac{2}{3}$; first A. ray nearer base of middle C. ray than vent. Known only from well at Corydon, Ind. (Named for Wyandotte Cave, not far from Corydon.)

309. **T. osborni** Eigenmann. Width of head $4\frac{1}{2}$; the body heavy-set; length of head $3\frac{1}{8}$; orbital fat mass round and very conspicuous in life, projecting as a dome above the general contour; cheeks much more swollen; eye less than .10 mm. in diameter. Mitchell's and Horse Caves, Ky. (To Henry Fairfield Osborn.)

164. TROGLICHTHYS Eigenmann (Gr., τρώγλη, cave; ἰχθύς, fish)

310. **T. rosae** (Eigenmann). Missouri Blindfish. Scleral cartilages large, forming a hook over front of eye; a mass of pigment in front of eye; retina with more or less of pigment; eye a mere vestige, ⅓ its size in *Typhlichthys*. Caves in Mo. (Named for Rosa Smith, now Mrs. Carl H. Eigenmann.)

165. AMBLYOPSIS De Kay (Gr., ἀμβλύς, blunt; ὄψις, vision)

311. **A. spelaeus** De Kay. Blindfish of Mammoth Cave. Head and body with papillary ridges; D. and A. equal, well developed; scales small. Colorless. Head 3; depth 4½. D. 10; A. 9; V. 4; P. 11. L. 2 to 5. Subterranean streams of Ky. and Ind., Mammoth Cave, etc. (Lat., living in caves.)

"If the *Amblyopses* be not alarmed, they come to the surface to feed, and swim in full sight, like white aquatic ghosts. They are then easily taken by the hand or net if perfect silence be preserved, for they are unconscious of the presence of an enemy except through the sense of hearing. This sense is, however, very acute; for at any noise, they turn suddenly and hide beneath stones at the bottom. They take much of their food near the surface, as the life of the depths is apparently very sparse. This habit is rendered very easy by the structure of the fish, for the mouth is directed upwards, and the head is very flat above, thus allowing the mouth to be at the surface." (*Cope.*)

Order XX. SALMOPERCAE (The Trout Perch)

This group, apparently a relic of an ancient fauna, shows the unique combination of true fin spines, ctenoid scales, and a perch-like mouth, with the adipose fin, naked head, and abdominal ventrals of the *Isospondyli*. Ventral fins with 1 or 2 spines and more than 5 soft rays, as in Berycoid fishes; the bones of the head cavernous. One family only.

Family LX. PERCOPSIDAE (The Trout Perches)

Body elongate, covered with moderate-sized, thin, strongly ctenoid scales; head naked; no barbels; opercles well developed; gill openings wide; an adipose fin; mouth small, horizontal; teeth very small, villiform; no teeth on vomer or palate; margin of upper jaw formed by premaxillaries alone, those short and not protractile; gill rakers tubercle-like; cavernous structure of the skull highly developed, as in *Stellifer*, *Acerina*, and *Ericymba;* fins much as in *Salmonidae*. Color pale, pellucid; B. 6; stomach siphonal, with about 10 pyloric caeca; ova large; no oviduct. Two species, inhabiting cold, fresh waters in the northern U. S. (*Columbia transmontana* from Columbia R. and the following). Interesting little fishes, with the general characters of *Salmonidae*, but having the mouth and scales decidedly perch-like.

166. PERCOPSIS Agassiz (Gr., πέρκη, perch; ὄψις, appearance)

312. **P. omiscomaycus** (Walbaum). Trout Perch. Sand Roller. Lower jaw included; tail long. Silvery; upper parts with rounded dark spots made up of minute dots. Head $3\frac{3}{4}$; depth $4\frac{1}{3}$. D. 11; A. 8. Lat. l. 50. L. 6. S. Canada and the Great Lakes and tributaries; rarely S.; Ohio R. (Jordan); Potomac R. (Baird); Delaware R. (Abbott); Kansas R. (Gill). (*P. guttatus* Agassiz.) (An Indian name.)

Order XXI. **XENARCHI** (The Pirate Perch)

This small transitional group shows considerable resemblance to the *Salmopercae*. It shows also many likenesses to the *Centrarchidae*. Dorsal single, spines few; ventrals thoracic, without spines, the rays 7; no adipose fin; vent at the throat in the adult, normally placed in the young; scales small; caudal rounded; preopercle serrate. One family living. Two extinct families, *Erismatopteridae* and *Asineopidae*, of the American Eocene, may belong with the *Xenarchi* or the *Salmopercae*. (Gr., ξενός, strange; ἄρχος, vent.)

Family LXI. APHREDODERIDAE (The Pirate Perches)

Body oblong, with broad head and compressed tail; mouth moderate, the chin projecting; teeth in villiform bands on jaws, vomer, and palatines; premaxillary not protractile; maxillary simple; preopercle and preorbital serrate; opercle with a spine; bones of skull somewhat cavernous; gill rakers tubercle-like; gill membranes slightly joined to isthmus; no pseudobranchiae; gills complete; B. 6; scales strongly ctenoid; no lateral line; vent anterior, below the preopercle in adult, farther back in young (*Sternotremia*), its position changing by a lengthening of the rectum; dorsal small, with 3 or 4 spines; anal with 2; ventrals without spine and with *seven* soft rays (all other perch-like fishes having 1 spine and 5 rays); C. rounded; air bladder large. Vert. 29. Pyloric caeca 12. One species, a small fish of nocturnal habits, abounding in sluggish, grassy, lowland streams throughout the eastern U. S.

167. APHREDODERUS Le Sueur (Gr., ἄφοδος, excrement; δέρη, the throat)

313. **A. sayanus** (Gilliams). Pirate Perch. Dark olive, profusely dotted with black; 2 dusky bars at base of C. Head 3; depth 3. D. III, 11; A. II, 6. Scales 48 to 58. L. 6. E. N. Y. to La. and N. to Minn. and L. Mich.; variable. (To Thomas Say, the entomologist.)

Order XXII. SYNENTOGNATHI The Synentognathous Fishes

(Gr., *συνφύω*, to grow together; *εντος*, within; *γνάθος*, jaws)

(Physoclistous fishes without spines in the fins, with the ventrals abdominal and the lower pharyngeals fully united)

Scales cycloid; a ridge, representing the lateral line, running alongside of belly; head scaly; premaxillaries not protractile, but with a hinge at base, forming most of margin of upper jaw; teeth various; D. posterior, similar to anal; ventrals inserted posteriorly; P. inserted high; C. usually forked, the lower lobe the longer; gill openings wide; pseudobranchiae hidden; air bladder large; intestinal canal simple. Sexes similar. Carnivorous. Species numerous, marine, sometimes entering rivers.

Family LXII. BELONIDAE (The Garfishes)

Characters given above; ovary single; lower pharyngeals united in a small linear plate; fourth upper pharyngeal distinct; jaws with sharp teeth, some of them canines; no finlets; maxillaries grown fast to premaxillaries; long-bodied, voracious fishes, in all warm seas, valued as food.

a. Gill rakers wanting; no teeth on vomer; dorsal and anal elevated anteriorly; caudal lunate.
  b. Body subterete; mouth closing completely; upper jaw not arched at base.
    c. Caudal peduncle more or less depressed, with a dermal keel.
      d. Dorsal and anal fins short, each of 14 to 19 rays, last rays not elevated; caudal weakly or not at all forked; species of moderate size. . . Strongylura, 168.
      dd. Dorsal and anal fins long, each of 17 to 25 rays, the last rays more or less elevated in the young; caudal strongly forked; caudal keel strong, black; opercle crossed by one or more folds of skin; bones green; size very large. Tylosurus, 169.
  bb. Body much compressed, somewhat band-shaped, its thickness not half its greatest depth; dorsal and anal very long, of 25 to 26 rays; bones green. . . . Ablennes, 170.

168. STRONGYLURA Van Hasselt (Silver Gars)

(Gr., *στρογγυλός*, cylindrical; *οὐρά*, tail)

314. **S. marina** (Walbaum). Garfish. Billfish. Silver Gar. Needlefish. Jaws slender; scales and bones green; color green, a silvery lateral band; a dark bar on opercles; P. pale. Head $2\frac{3}{4}$; depth $5\frac{1}{2}$. D. 15; A. 17. Scales 300. L. 4 feet. Me. to Texas; abundant; ascending rivers.

169. TYLOSURUS Cocco (Long Toms) (Gr., *τύλος*, callus (keel); *οὐρά*, tail)

a. Bill comparatively short and strong, less than twice as long as rest of head; scales 350.

315. **T. raphidoma** (Ranzani). Hound Fish. D. 21 to 24; A. 22 to 24. One or more folds of skin across edge of preopercle. Body robust, little compressed. Adults N. to N. C.; young ranging farther. (Gr., *ῥαφίς*, a sharp instrument; an old name of the pike.)

aa. Bill long, at least twice rest of head.
  b. Upper jaw not arched at base; scales about 380.

316. **T. acus** (Lacépède). Hound Fish. Agujon. Green Gar. Beak long, twice rest of head. Green, no lateral stripe. 23. A. 21. Scales 380. L. 6 feet. A huge, swift fish. Mediterranean, occasional N. to Cape Cod. (*Eu.*) (Lat., needle.)

bb. Upper jaw conspicuously arched at base; scales about 255.

317. **T. caribbaeus** (Le Sueur). Garfish. D. 24; A. 22; depth 20. Caribbean Sea, N. to N. C. (Lat., Caribbean.)

170. ABLENNES[1] Jordan & Fordice (Gr., ἀβλεννής, without mucosity, an ancient epithet applied to the Needlefish, *Belone belone* of Europe)

318. **A. hians** (Cuvier & Valenciennes). Jaws long and very slender, the upper arched at base, so that the mouth cannot be closed; tail not keeled; eye very large; scales minute; D. elevated behind. D. and A. long, each of 24 to 26 rays, last rays of D. more or less elevated. Green, sides silvery; young with a series of large quadrate or round dark spots. D. 25; A. 26. Scales 520. L. 40. W. I., occasional N. (Lat., gaping.)

Family LXIII. SCOMBERESOCIDAE (The Sauries)

Body long and slender; fins small; teeth small, even; about 6 finlets behind dorsal and anal; characters otherwise included above. A small family of surface swimmers, inhabiting warm seas.

171. SCOMBERESOX Lacépède (Scomber + Esox)

319. **S. saurus** (Walbaum). Saury. Skipper. Fins small; C. forked; both jaws produced in a slender beak; the snout longer than rest of head. Olive; sides with distinct silvery band. Head $3\frac{1}{3}$; depth 9. D. 9–VI; A. 12–VI. Scales 110. L. 18. Open Atl.; not rare: in large schools, skipping along the surface. (*Eu.*) (An old name, "lizard fish.")

Family LXIV. HEMIRAMPHIDAE (The Halfbeaks)

Lower jaw usually produced in a long and pointed beak, usually longer than rest of head; teeth small, even; sexes similar. Surface fishes, swimming in schools.

a. Body moderately compressed; pectorals and ventrals small; shore fishes; vertebrae about 50.
  b. Dorsal and anal about equal; ventrals far in advance of dorsal; air bladder simple; last ray of dorsal not produced. . . . . Hyporhamphus, 172.
  bb. Dorsal notably longer than anal; ventrals not much before dorsal; air bladder cellular; sides more or less flattened; last ray of dorsal slightly produced. Hemiramphus, 173.
aa. Body very slender, greatly compressed, band-like; pectorals very long; ventrals very short, the upper ray strong. Pelagic, having some power of flight, vertebrae 70 or more. Euleptorhamphus, 174.

[1] Inadvertently misprinted *Athlennes.*

172. HYPORHAMPHUS Gill (Gr., ὑπό, below; ῥάμφος, beak)

320. **H. unifasciatus** (Ranzani). Halfbeak. Pajarito. Very slender, the lower jaw very long. Head without beak, $2\frac{1}{3}$; depth $7\frac{1}{3}$. D. 15. A. 16; gill rakers 21 below angle; scales 54. Vert. 51. Green, side with a silvery stripe; scales dark edged; tips of vertical fins dusky; peritoneum black. Tropical America, recorded from Brazil N. to N. J., on sandy shores, in great schools, closely pursued by predatory fishes; excellent as food. A closely related species, **H. hildebrandi** Jordan & Evermann (miscalled *roberti*), ranges from the West Indies N. in the Gulf Stream. It has 29 gill rakers below.

173. HEMIRAMPHUS Cuvier (The Balaos) (Gr., ἡμι, half; ῥάμφος, beak)

321. **H. brasiliensis** (Linnaeus). Balao. Escribano. Body slabsided; anal much smaller than dorsal, its last ray a short filament. Color dark blue-green; sides silvery, but without lateral stripe; tip of beak and tips of D. and C. bright orange; head $2\frac{3}{4}$; with lower jaw 5; depth $6\frac{2}{3}$. D. 14. A. 12. Scales 53. W. I.; common; once taken at Hunger's Wharf, Va., and once at Woods Hole. (In the West Indies is a similar species, *H. balao* Le Sueur, with the lobes of D. and A. bluish, not orange.)

174. EULEPTORHAMPHUS Gill (Gr., εὐλεπτός, very slender; ῥάμφος, beak)

322. **E. brevoortii** Gill. Lower jaw much longer than rest of head, as long as the long pectoral, which is 4 in body; no lateral stripe. Head $6\frac{2}{3}$; depth 10. D. 22; A. 19. L. 18. Open sea, W. I.; occasional N. to Cape Cod. Several nominal species of the tropics need comparison, as all may be identical with *E. longirostris* (Cuvier). (To James Carson Brevoort.)

Family LXV. EXOCOETIDAE (The Flying Fishes)

Body elongate, covered with large cycloid scales; lateral line running very low, along side of belly; sides of head scaled; nostrils large, double; mouth moderate, terminal, the jaws not prolonged; premaxillary not protractile, forming most but not quite all of the margin of the upper jaw; maxillaries slipping under edge of preorbital; teeth small and even; dorsal without spines, inserted opposite anal and nearly similar to it; ventrals abdominal, inserted well back; no finlets; caudal unequally forked, the lower lobe enlarged; pectoral very long, inserted high, used as an organ of flight, or rather of gliding, its muscles very strong. Lower pharyngeals enlarged, united to form a large concave plate, covered with coarse, blunt, tricuspid teeth; third upper pharyngeals large, separate; fourth obsolete; air bladder very large; pseudobranchiae glandular; intestinal canal without caeca. Vert. 50. Species about 70. Pelagic fishes, in all warm seas, remarkable for their power of gliding through the air.

The flying fishes live in the open sea, swimming in large schools. They will "fly" a distance of from a few yards to more than an eighth of a mile, rarely rising more than 3 or 4 feet. Their movements in the water are extremely rapid; the sole source of motive power is the action of the strong tail while in the water. No force is acquired while the fish is in the air. On rising from the water, the movements of the tail are continued until the whole body is out of the water. While the tail is in motion, the pectorals seem to be in a state of rapid vibration, but this is apparent only, due to the resistance of the air to the motions of the animal. While the tail is in the water, the ventrals are folded. When the action of the tail ceases, the ventrals as well as the pectorals are spread and held at rest. They are not used as wings, but act rather as planes to hold the body in the air. When the fish begins to fall, the tail touches the water and its motion again begins, and with it the apparent motion of the pectorals. It is thus enabled to resume its flight, which it finishes finally with a splash. While in the air it resembles a large dragon fly. The motion is very swift, at first in a straight line, but later deflected into a curve. The motion has no relation to the direction of the wind. When a vessel is passing through a school of these fishes, they spring up before it, moving in all directions, as grasshoppers in a meadow.

The young of certain species have long fleshy barbels at tip of the lower jaw. These are lost with age.

a. Roof of mouth well covered with teeth; pectorals moderate, not reaching beyond middle of dorsal; ventrals long, behind middle of body; anal about as long as dorsal; dorsal elevated; snout short, much shorter than eye. . . . . PAREXOCOETUS, 175.

aa. Roof of mouth with few teeth or none; pectorals very long, about reaching to caudal; jaws short.

b. Ventrals rather small, inserted anteriorly, not serving as organs of flight, their tips not reaching front of dorsal; anal about equal to dorsal. . . . . EXOCOETUS, 176.

bb. Ventrals very large, inserted posteriorly near middle of body, serving as well as the pectorals as organs of flight, their tips extending beyond front of dorsal, nearly to caudal.

c. Anal fin long, its base about equal to that of dorsal, the rays of each fin 11 or 12. EXONAUTES, 177.

cc. Anal fin moderate, its base less than ⅔ that of dorsal; dorsal rays about 14; anal rays usually 9 or 10. . . . . CYPSELURUS, 178.

175. **PAREXOCOETUS** Bleeker (Gr., *παρά*, near + *Exocoetus*)

323. **P. mesogaster** (Bloch). Second ray of P. divided; D. very high. Blue; sides silvery; D. largely black; other fins pale, young with a fleshy lobe at chin. Head 4⅔; depth 5. D. 12; A. 13. Lat. l. 38. L. 6. Open sea, N. to R. I.; scarce. (Gr., *μέσος*, median; *γαστήρ*, belly.)

176. **EXOCOETUS** (Artedi) Linnaeus (*Halocypselus* Weinland)

(Gr., *ἐξωκοιτος*, sleeping outside — old name of some blenny)

324. **E. volitans** Linnaeus. Second ray of P. divided; anal white, nearly as long as dorsal; V. pale. Head 4; depth 5½. D. 13; A. 13. Lat. l. 42.

L. 9. Open sea in all warm oceans, N. to Cape Cod. (*Exocoetus volitans* and *E. evolans* L.) (Lat., flying.)

177. EXONAUTES Jordan & Meek (Gr., ἐξώ, outside; ναυτής, sailor)

a. Second ray of P. simple, as well as the first, fourth and fifth rays longest; V. largely black.
b. Second ray of P. scarcely longer than first.

325. **E. exsiliens** Müller (1776). Eye large. V. $2\frac{1}{3}$ in body, reaching C.; P. and V. marbled with black and white; D. with black spot anteriorly; A. white; a dark blotch at base of C. Head 4; depth $5\frac{1}{2}$. Scales 48. L. 10. Open sea; occasional N. (Lat., leaping out.)

bb. Second ray of P. nearly half longer than first.

326. **E. rondeletii** (Cuvier & Valenciennes). Eye moderate; V. $3\frac{1}{2}$ in body, reaching last ray of A.; P. $1\frac{3}{8}$ in body; head $4\frac{1}{2}$; depth $5\frac{1}{2}$. Scales 50. Ventrals chiefly black; P. dusky; no black on D. or A. Open Atl., frequently N. (*Eu.*) (For Guillaume Rondelet, one of the fathers of ichthyology.)

aa. Second ray of P. divided; third or fourth longest.
d. Ventrals chiefly black, inserted midway between eye and base C.

327. **E. vinciguerrae** (Jordan & Meek). P. dusky, uniform or with a small white cross-stripe; D. and A. without black. Head $4\frac{1}{3}$; depth $6\frac{1}{2}$. Scales 48. L. 12. Atl., N. to Grand Banks. (*Eu.*) (To Dr. Decio Vinciguerra, of Rome.)

328. **E. rubescens** (Rafinesque). P. dark brown, with an oblique whitish band from axil to middle of fin; D. and A. without black. Head $4\frac{1}{4}$; depth $6\frac{1}{2}$. D. 12; A. 11. Scales 55. L. 12. Atl., N. to Grand Banks, frequent. (*Eu.*) (Lat., reddish.)

178. CYPSELURUS Swainson (*Cypselus*, the swift + Gr., οὐρά, tail)

a. Second ray of pectoral divided (the first simple); third and fourth longest; V. midway between eye and tail; P. without round black spots; young with barbels.
b. D. and A. plain whitish.
c. Base of anal 2 in base of dorsal; pectoral $1\frac{2}{5}$ in length; ventrals nearly 3.

329. **C. lutkeni** (Jordan & Evermann). P. with an oblique white band on lower two thirds of fin. Head $4\frac{1}{4}$; depth $5\frac{1}{3}$. Scales 50. L. 9. Atl.; rare in N. C. (To Christian Lütken.)

cc. Base of anal $1\frac{2}{3}$ in length, pectoral $1\frac{1}{2}$ in length; ventrals $2\frac{3}{4}$.

330. **C. heterurus** (Rafinesque). P. with an oblique white band on lower half. Head $4\frac{2}{3}$; depth $5\frac{1}{3}$. Scales 58. L. 12. Atl.; the commonest species off our coasts. (*Eu.*) (Gr., ἑτερός, unequal; οὐρά, tail.)

bb. D. and A. blotched or spotted with black; V. chiefly black.

331. **C. furcatus** (Le Sueur). P. black, with a white band; C. with 3 dusky crossbars. Head $4\frac{1}{2}$; depth $5\frac{1}{4}$. Scales 46. L. 12. Warm Atl., N. to Cape Cod. (*Eu.*) (Lat., forked.)

bbb. D. largely jet black; A. white, except on posterior border.

332. **C. nigricans** (Bennett). D. 14; A. 9; scales 48 to 52. Upper C. lobe white except at base; lower lobe jet black; P. largely black; V. black in outer two thirds. L. 10. Tropical Atlantic, rare N. to N. J. (Lat., blackish.)

aa. Second ray of P. simple, like the first; V. chiefly black.

333. **C. gibbifrons** (Cuvier & Valenciennes). Snout more bluntly rounded than in any other species, $4\frac{1}{2}$ in head; V. midway between eye and C. P. dusky, paler at base; vertical fins plain, rather dusky. Head 4; depth $5\frac{1}{2}$. Scales 46. L. 12. N. Atl., rare. (Lat., *gibbus*, swollen; *frons*, front.)

Order XXIII. THORACOSTEI (The Sticklebacks and Pipefishes)

Pharyngeal bones and other structures about the head more or less reduced. Body elongate, covered more or less completely by bony plates, dorsal spines few or wanting; ventrals much reduced or wanting, subabdominal in position. (Gr., *θόραξ*, breast; *ὀστέον*, bone.)

Suborders of Thoracostei

a. Body much elongate; snout long, tubular; gills reduced to a tuft of filaments; jaws short, toothless; chiefly tropical. . . . . Lophobranchii.

aa. Body moderately elongate; snout shorter; teeth well developed; gills normal; ventrals reduced to a spine and one or two rays; dorsal spines 3 to 11. Species all Northern, in streams and estuaries. . . . . Hemibranchii.

aaa. Body elongate; snout a long dilatable tube; gills normal; jaws with minute teeth; ventrals with 6 rays. . . . . Aulostomi.

Suborder LOPHOBRANCHII (The Tuft-gilled Fishes)

Gills contracted, tufted, composed of small rounded lobes, attached to the gill arches; pharyngeal bones reduced in number; mouth very small, toothless, at the end of a tubular snout; post-temporal grown fast to skull; anterior vertebrae modified, with expanded apophyses; gill covers reduced to a simple plate; skin with bony plates arranged in rings; fins small. Two families; the E. Indian *Solenostomidae* have both spinous dorsal and ventral fins; ours lack both. (Gr., *λόφος*, tuft; *βράγχος*, gill.)

Family LXVI. SYNGNATHIDAE

(The Pipefishes and Sea Horses)

Body elongate, covered with bony rings; gill openings reduced to a small aperture behind upper part of opercle; no spinous dorsal nor ventral fins;

caudal small or wanting; anal minute, of 1 or 2 rays; tail long. Male fishes with an egg-pouch, usually placed on under side of tail and formed of two folds of skin which meet on the median line. The eggs are received from the female into this pouch, and retained for some time after hatching, when the pouch opens and the young, then $\frac{1}{3}$ to $\frac{1}{2}$ inch long, escape. Species many, in all warm seas.

a. Axis of head in a line with axis of body. (*Syngnathinae.*)
b. Humeral bones united below; C. present; P. well developed; D. opposite vent or before it; shields not spinous. . . . . SYNGNATHUS, 179.
aa. Axis of head forming an angle with axis of body; the head and neck horse-shaped, like that of a "Knight" at chess. (*Hippocampinae.*)
c. Body compressed; occiput with a narrow, bony crest, surmounted by a star-shaped coronet; shields tubercular or spinous; egg-sac in male at base of tail, which is prehensile and without fin. . . . . HIPPOCAMPUS, 180.

179. SYNGNATHUS Linnaeus (PIPEFISHES) (Gr., *σύν*, together; *γνάθος*, jaw)

a. Trunk rings 17 to 19; caudal rings 31 to 33; D. 29 to 31, extending over 1 to 2 trunk rings; snout more than half length of head.

334. **S. floridae** (Jordan & Gilbert). FLORIDA PIPEFISH. Tail a little longer than trunk. Dark or light green, with gray specks on sides and dark bars or oblong spots on tail. Md. to Texas.

aa. Trunk rings 20 or 21; caudal rings 36 to 38.
b. Snout more than half head; belly flat or concave; D. shorter than head, with 32 to 37 rays, extending over 3 or 4 trunk rings.

335. **S. louisianae** Günther. LOUISIANA PIPEFISH. Head 7 to $7\frac{1}{2}$. Brownish, lighter below; a brown band on sides. N. C. to Texas.

bb. Snout half length of head; belly convex; D. longer than head, with 38 to 41 rays, extending over 4 or 5 trunk rings.

336. **S. peckianus**[1] Storer. COMMON PIPEFISH. Top of head slightly keeled; D. covering 4 trunk rings and 5 behind vent; rings 18 to 20 + 36 to 40; dorsal rays 36 to 40; snout moderate. Head 9; L. 7. Olivaceous, sides mottled. Newfoundland to Va., common. (*S. fuscus* Storer.)

180. HIPPOCAMPUS Rafinesque (SEA HORSES)

These small fishes inhabit grassy bays and often the open sea in warm regions. They are wont to twist the very prehensile tail around pieces of floating seaweed or eelgrass. They are thus often drifted to great distances in the sea. The species are very similar to one another, and not easily distinguished. (Ancient name from Gr., *ἵππος*, horse, and *κάμπος*, a wriggling creature.)

a. Dorsal fin covering $1\frac{1}{2}$ trunk rings and 2 caudal rings.

[1] The name *fuscus* has line priority, but the first reviser, Dr. Storer, preferred *peckianus*.

337. **H. punctulatus** Guichenot. Spotted Sea Horse. Dark brown, with darker marblings and many light blue spots. Ten trunk rings. N. to N. J. (Lat., dotted.)

aa. Dorsal fin covering 3½ trunk rings but no caudal rings.

338. **H. hudsonius** De Kay. Sea Horse. Dusky, unspotted, but with grayish blotches, edged with blackish; D. with a dark band; snout 1⅓ in head; spines on head weak, provided with cirri; spines all bluntish. D. 19, on 3½ of the 11 body rings. L. 6. Nova Scotia to Fla., not common. Several other species occur S. (Named for the Hudson R.)

Suborder **HEMIBRANCHII** (The Half-Gilled Fishes)

Family LXVII. **GASTEROSTEIDAE** (The Sticklebacks)

Body elongate, with slender tail, naked, or shielded with bony plates; head large, compressed, the snout not tubular; mouth moderate, the chin prominent; teeth sharp, in jaws only; suborbital large. B. 3; opercles unarmed. D. with 2 to 15 free spines; A. with one spine; V. subabdominal with a sharp spine and 1 or 2 rays. P. short, well behind gill openings, preceded by an area covered with smooth skin. Fresh and brackish waters of Northern regions; small fishes, lively, greedy, and quarrelsome, and exceedingly destructive to the spawn of other fishes. Most of them build nests, which they defend with much spirit.

a. Innominate bones of the pelvis joined, forming a median plate on belly, behind V. (*Gasterosteinae.*)
  b. Gill membranes connected, their border free from isthmus; spines small.
    c. Dorsal spines 7 to 11, divergent; pubic bones long, weak, widely divergent; body slender, mostly naked. . . . . Pungitius, 181.
    cc. Dorsal spines 5, in right line; pubic bones short, widely divergent; body stoutish, naked. . . . . Eucalia, 182.
  bb. Gill membranes not connected across the isthmus; dorsal spines 3 or 4, strong, divergent; pubic bones broad, nearly parallel; form stoutish, robust; skin usually mailed.
    d. Ventral spine serrate; ventral rays I, 1 only. . . . . Gasterosteus, 183.
    dd. Ventral spine not serrate but with very strong basal cusps; ventral rays I, 2. Gla[illegible]unculus, 184.
aa. Innominate bones not joined, each extending as a strong process under the skin, outside of V., the area between them flat and not bony; pubic bones weak; dorsal spines 4, divergent; gill membranes joined to isthmus; tail very slender; skin smooth. (*Apeltinae.*) Apeltes, 185.

181. **PUNGITIUS** Coste (*Pygosteus* Brevoort)

339. **P. pungitius** (Linnaeus). Nine-spined Stickleback. Olivaceous, punctulate and irregularly barred with black. Tail keeled; eye large. Head 4; depth 5 to 6. D. IX–I, 9. A. I, 8. L. 2½. New Jersey to L. Mich., N. to Greenland, in fresh waters and entering sea. (*Eu.*) (Lat., pungent.)

182. EUCALIA Jordan (Gr., *εὖ*, good; *καλία*, nest)

340. **E. inconstans** (Kirtland). Brook Stickleback. ♂ in spring jet black, reddish-tinged; ♀ olivaceous, mottled and dotted. No dermal plates, the bones and spines all weak; pectoral plate V-shaped; tail not keeled; head 3½; depth 4; D. IV–I, 10. A. I, 10; L. 2½. Maine to Kansas, and northward to the Saskatchewan; abundant in small brooks N. W. (Lat., variable.)

183. GASTEROSTEUS Linnaeus (Gr., *γαστήρ*, belly; *ὀστέον*, bone)

(Three-spined Sticklebacks)

341. **G. aculeatus** Linnaeus. Common Stickleback. Burnstickle. Olivaceous, dotted or mottled above, sides silvery; rugose plates at base of spines. Head 3½; depth 4½ to 5. D. II–I, 13. A. I, 9. V. I, 1. L. 2½ to 4. N. J. to Greenland and N. Europe, also in the north Pacific, in both coasts, the typical form in salt water, having the sides completely mailed, with 25 to 35 bony plates, the tail keeled. (*Eu.*) In regions where this form occurs, in Europe, New England, California, and Japan, there are also in fresh waters similar fishes, but only half armed. (The half-armed subspecies of eastern North America is **cuvieri** Girard, distinguished by its long spines.) (Lat., pointed.)

184. GLADIUNCULUS Jordan & Evermann (Lat., a little sword)

342. **G. wheatlandi** (Putnam). Two-spined Stickleback. Color dark, a few lateral plates; no caudal keel, body deeper than in *G. aculeatus;* ventral spine never serrate, but with a strong cusp at base and two soft rays. D. II, 10 or 11. A. I, 8. V. I, 2. New England and N.; rare, known from Woods Hole and Boston Harbor in Mass., from Casco Bay, Eastport, and elsewhere in Maine, and from Miramichi R., N. B., in salt or brackish water (Kendall); also recorded from Newfoundland. (*G. biaculeatus* Cuvier & Valenciennes, not of Mitchill; *G. gladiunculus* Kendall.) (To Rev. R. H. Wheatland.)

185. APELTES De Kay (Gr., *ἀ*, privative; *πέλτη*, shield)

343. **A. quadracus** (Mitchill). Olive, mottled; males nearly black, the V. red in spring; body plump, with long, slender tail; skin never mailed. Head 4; depth 4. D. III, I, 11. A. I, 8. L. 2. Md. to Labrador; abundant along coast, chiefly in salt water. (Lat., four-spined.)

Suborder **AULOSTOMI** (The Trumpet Fishes)

Body oblong or elongate, naked or covered with small scales, or bony plates. Snout a long dilatable tube; jaws short, with minute teeth, at the end of the snout. Spinous dorsal, of a few slender free spines; ventrals abdominal, of six rays. (Gr., *αὐλός*, tube; *στόμα*, mouth.)

Family LXVIII. FISTULARIIDAE (The Trumpet Fishes)

Body elongate; naked, with some bony plates; snout produced in a long dilatable tube, with the short jaws at the end; teeth minute; no spinous dorsal; C. forked, its middle rays produced in a very long filament; V. small, with 6 rays. Tropical seas; species few.

186. FISTULARIA Linnaeus (Lat., *fistula*, a tube)

344. **F. tabaccaria** Linnaeus. Trumpet Fish. Brown, with blue spots. Head 2¼. D. 14. A. 13. Warm seas, rarely N. to Cape Ann, Mass. (Low Lat., pertaining to a tobacco pipe.)

Order XXIV. ANACANTHINI

This order is distinguished chiefly by the total absence of spines in the fins, and usually also by the absence of any foramen in the scapular bone. The ventrals are jugular, of few or many rays; scales various; the tail isocercal; no pseudobranchiae. With the exception of the genus *Lota*, all are marine, and largely of the deep seas. (Gr., *ἀ*, without; *ἄκανθα*, spine.)

Family LXIX. GADIDAE (The Codfishes)

Body elongate, ending in an isocercal tail; mouth large; teeth various; scales small, cycloid; no pseudobranchiae; vertical fins separate; D. and A. long; no fin spines; gill openings very wide, the membranes free from the isthmus; gills 4; air bladder present; pyloric caeca numerous. Vert. about 50. Carnivorous fishes, chiefly of the Northern seas, many of them of great economic value; one genus (*Lota*) in fresh waters.

a. First D. composed of a band of fringes, preceded by a single ray. (*Gaidropsarinae.*)
  b. Barbels 4; 1 on chin, 1 on each nostril, 1 on snout; anal fin single. Enchelyopus, 187.
aa. First D. of distinct rays.
  c. Dorsal fins 2; anals 2. (*Lotinae.*)
    d. Ventrals narrow, filamentous, each of 2 or 3 slender rays.
      e. First dorsal with a long filamentous ray. . . . . Phycis, 188.
      ee. First dorsal without filamentous ray. . . . . Urophycis, 189.
    dd. Ventrals broader, each of about 6 rays; vomer with teeth; no canines. Lota, 190.
  cc. Dorsal and anal fins each single; ventrals well developed. (*Brosminae.*) Brosme, 191.
  ccc. Dorsal fins 3; anals 2. (*Gadinae.*)
    f. Lower jaw included; barbel well developed.
      g. Vent below 2d D.
        h. Shoulder girdle with its chief bone or coracoid much swollen. (Lateral line black; maxillary not reaching eye.) . . . . . Melanogrammus, 192.
        hh. Shoulder girdle normal. (Lateral line pale; maxillary reaching past front of eye.) Gadus, 193.
      gg. Vent in front of 2d D. (Skull peculiar.) . . . . . Microgadus, 194.
    ff. Lower jaw projecting; barbel minute; teeth of upper jaw subequal. Pollachius, 195.
  cccc. Dorsal fins 2; anal single. (*Merluccinae.*) . . . . . Merluccius, 196.

187. ENCHELYOPUS Schneider (Gr., ἐγχελυωπός, resembling an eel, "*facie anguillaris*") (*Rhinonemus* Gill)

345. **E. cimbrius** (Linnaeus). Four-bearded Rockling. Mackerel-midge (young). Head high, compressed; mouth large; no canines, front teeth enlarged. Salmon-red; D. and A. behind and C. below, abruptly black; mouth dark within. Head 5½; depth 9. D. 48, preceded by fringes. A. 42; V. 5. Lat. l. with 35 pores. L. 12. N. C. and N. (*Eu.*) (Lat., Welsh.)

188. PHYCIS Röse (Gr., φυκίς, an ancient name)

a. Filamentous ray of D. more than twice head.

346. **P. chesteri** Goode & Bean. Brownish. Head 4¼; depth 5. D. X, 56; A. 56. Lat. l. 90. Mass., in rather deep water; very abundant. (To Captain H. C. Chester, U. S. F. C.)

aa. Filamentous ray of D. not twice head.
b. Scales moderate; lat. l. 110.

347. **P. chuss** (Walbaum). Chuss. Codling. Squirrel Hake. Brownish, punctulate, yellowish below. Head 4½; depth 5. D. 9–57; A. 50. L. 27. Va., N. in rather deep water; common. (Vernacular name.)

bb. Scales very small; lat. l. 140.

348. **P. tenuis** (Mitchill). White Hake. Codling. Brown, yellowish below; fins very dark. Head 4¼; depth 5½. D. 9, 57; A. 48. L. 40. N. C., N. (Lat., slender.)

189. UROPHYCIS Gill (Gr., οὐρά, tail + *Phycis*)

349. **U. regius** (Walbaum). Spotted Codling. Yellowish brown; lateral line dark, interrupted by white spots; sides of head and 2d D. with black spots; 1st D. largely black. Head 4¼; depth 4½. D. 8–43; A. 45. Lat. l. 90. L. 12. Cape Cod to Fla., in moderate depths. (Lat., royal.)

350. **U. earlli** Bean. Dickie. Brown, with small light blotches on back and sides; D. and A. edged with brown. D. 10–60; A. 53. Lat. l. 155. L. 18. N. C. and S. C. (To R. Edward Earll.)

351. **U. floridanus** (Bean & Dresel). Florida Hake. Reddish brown; lateral line black, interrupted frequently by light spots; vertical fins becoming dusky distally. D. 13–57; A. 49. Lat. l. 120. N. C. to Gulf of Mexico. (Lat., from Florida.)

190. LOTA Cuvier (Lota, the ancient name)

352. **L. maculosa** Le Sueur. Burbot. Lawyer. Ling. Head depressed; maxillary reaching posterior margin of the very small eye; scales very small. Dark olive, thickly marbled and reticulate with blackish, the adult duller; edges of vertical fins dusky. Head 4⅔; depth 6. D. 13–76;

A. 68; V. 7. Vert. 59. Caeca 30. L. 30. Arctic America and S. to Connecticut R., Ohio R., etc.; abundant in lakes. A fish of little value as food, but widely distributed. (A closely related species, *L. lota* (L.) abounds in N. Europe.) (Lat., spotted.)

191. **BROSME** (Cuvier) Oken (Cusks)

353. **B. brosme** (Müller). Cusk. Brownish, usually mottled with yellowish. Head $4\frac{1}{4}$; depth $5\frac{1}{4}$. D. 98; A. 71. New Jersey, N.; not common. (*Eu.*)

192. **MELANOGRAMMUS** Gill (Gr., *μελάς*, black; *γραμμή*, line) (Haddocks)

354. **M. aeglifinus** (Linnaeus). Haddock. Snout long; dorsals pointed; C. lunate; skull depressed, the bones thin; the supraoccipital crest very high, with wing-like projections at base. Dark gray; lateral line black; a large black blotch above P. Head $3\frac{3}{4}$; depth $4\frac{1}{2}$. D. 15–24–21; A. 23–21; L. 30. Va. N.; common, northward. A valued food fish, especially in N. Eu. (*Eu.*) (An old name, perhaps from *aigrefin* or *aigrefaim*, very hungry.)

193. **GADUS** (Artedi) Linnaeus (Latin name, akin to Cod)

355. **G. morrhua** Linnaeus. Codfish. Head large; occipital keel not high; fins not elevated; C. slightly notched. Brownish, the ground color varying much; lateral line pale, back and sides with round brownish spots; fins dark. Head $3\frac{1}{3}$ to $4\frac{1}{2}$; depth 4. D. 14–21–19; A. 20–18. L. 3 feet or more. N. Atl. S. to N. C. One of the most important of food fishes. (*G. callarias* Linnaeus, young.) (Lat., *morrhua*, Cod.)

194. **MICROGADUS** Gill (Gr., *μικρός*, small; Lat., *Gadus*)

356. **M. tomcod** (Walbaum). Tomcod. Frostfish. Vent before second dorsal; snout rounded; maxillary reaching pupil, $2\frac{1}{2}$ in head; eye $3\frac{2}{5}$. Olive-brown, spotted and blotched with darker; skin punctulate. Head $3\frac{2}{3}$; depth 5. D. 13–17–18; A. 16 to 20–17. L. 12. Va. to Labrador; a diminutive Codfish, common N.

195. **POLLACHIUS** Nilsson (Pollacks)

357. **P. virens** (Linnaeus). Pollack. Coalfish. P. short, scarcely reaching A. Greenish, somewhat silvery below; fin pale; usually a dark spot in axil. Head 4; depth $4\frac{1}{4}$. D. 13–22–20. A. 24. Scales 250. L. 18. Va., N. (*Eu.*) (Lat., green.)

196. **MERLUCCIUS** Rafinesque. (*Merluccius*, "Sea Pike," the ancient name)

358. **M. bilinearis** (Mitchill). Silver Hake. Stockfish. Whiting. Top of head with well-defined W-shaped ridges; teeth not very large; P.

and V. long, $\frac{2}{5}$ head; flesh soft; grayish; sides dull silvery; axil, inside of mouth and peritoneum black. Head $3\frac{3}{4}$; depth $6\frac{1}{2}$. D. 13–41; A. 40. Lat. l. 105. L. 2 feet. Va. to Newf., S. in deeper water; rather common. An important food fish. (The European Hake, *M. merluccius*, has smaller scales (150) and larger teeth.) (Lat., two-lined.)

Family LXX. CORYPHAENOIDIDAE (The Grenadiers)

Body elongate, tapering into a long, compressed tail, ending in a point. Scales very rough. Of this large group, many species occur in deep waters in all seas, very rarely coming into the markets. Of the many species approaching our coasts, the most abundant is **Coryphaenoides bairdii** (Goode & Bean), the common Rat-tail or Grenadier. (This family is more often called *Macrouridae*, but *Macrourus* is inseparable from *Coryphaenoides*, an earlier name.)

Order XXV. SELENICHTHYES (The Opahs)

Large fishes of the open sea, the body much compressed, almost orbicular, the group especially distinguished by the extraordinarily developed shoulder girdle and by the presence of about 15 rays in the ventrals. Only one species living, notable from its color of red brocade, and the remarkable development of the shoulder girdle. (Gr., σηλήνη, moon; ἰχθύς, fish.)

Family LXXI. LAMPRIDAE (The Opahs)

(A single species, cosmopolitan)

197. LAMPRIS Retzius (Gr., λαμπρός, radiant)

359. **L. regius** (Bonnaterre, 1788). Opah. Mariposa. San Pedro Fish. In all warm seas but everywhere rare. Excellent as food. Reaching a length of 5 feet, almost as deep as long; the color a rich brocade of dark red and pale markings. (*Zeus laevia* Gmelin, 1789; *Zeus guttatus* Brünnich, 1788.) (Lat., royal.)

Order XXVI. HETEROSOMATA (The Flatfishes)

This group seems to be an offshoot from early spiny rayed fishes. Its essential feature is in the unsymmetrical character of the bones of the head. The head is twisted about, so that both eyes are on the same side. The body is compressed, and the side without eyes is habitually kept lowermost. The blind side is usually colorless. The very young are symmetrical, one eye on each side, the body is translucent, and the fish is vertical in the water. The different processes by which the eye of the lower side becomes transferred through or over the head to the other side are very curious and interesting. The species of northern seas have, as usual among fishes, an increased number of vertebrae — 40 to 70; the tropical forms have 30 to 35. (Gr., ἕτερος, different; σόμα, body.)

Family LXXII. HIPPOGLOSSIDAE (The Halibuts)

Body strongly compressed, the cranium twisted so that both eyes are on the colored side; mouth large, the dentition strong; premaxillaries protractile; maxillary simple; pseudobranchiae present. D. many-rayed; A. similar, shorter. Edge of preopercle free; teeth present; P. and V. usually well developed. Ventral fins symmetrical, similar in position and in form of base, the ventral of eyed side not extended along the ridge of abdomen. Species numerous, in most seas, especially N.; chiefly found on sandy bottoms, some of them ascending rivers.

a. Eyes and color on the right side. (*Hippoglossidae*).
  b. Vertebrae and fin rays much increased in number (Vert. about 50; D. 100; A. 85); body elongate; C. lunate; lateral line simple; no pre-anal spine; teeth not arrow-shaped.
    c. Lateral line without arch. . . . . Reinhardtius, 198.
    cc. Lateral line with an arch anteriorly. . . . . Hippoglossus, 199.
  bb. Vertebrae and fin rays in moderate number (Vert. less than 46; D. less than 95; A. less than 75); C. double truncate.
    d. Lateral line without arch; Vert. 45; eyes on right side; scales firm, ciliated; spine before A. strong; D. beginning above eye. . . . . Hippoglossoides, 200.
aa. Eyes and color on the left side (with rare exceptions). (*Paralichthyinae.*)
  e. Lateral line arched in front; Vert. 35 to 41.
    f. Scales weakly ciliated; anterior rays of dorsal shorter and connected by membrane. Paralichthys, 201.
    ff. Scales strongly ctenoid; anterior rays of dorsal exserted and forming a distinct lobe. Ancylopsetta, 202.

198. REINHARDTIUS Gill (named for Johann Reinhardt, a Danish naturalist)

360. **R. hippoglossoides** (Walbaum). Greenland Halibut. Brown. D. 100; A. 75. L. 4 feet or more. Cape Sable, N.; rather rare. (*Hippoglossus* + Gr., *εἶδος*, like.)

199. HIPPOGLOSSUS Cuvier (Old name from Gr., *ἵππος*, horse; *γλῶσσα*, tongue)

361. **H. hippoglossus** (Linnaeus). Halibut. Eyes large. Dark brown. Head 3¾; depth 3. D. 105; A. 78. L. 6 feet or more. In all Northern seas. The largest and most valuable of the flatfishes, reaching 400 pounds. (*Eu.*)

200. HIPPOGLOSSOIDES Gottsche

362. **H. platessoides** (Fabricius). Rough Dab. Sand Dab. Eyes large; teeth uniserial. Plain reddish brown. Head 3¾; depth 2½. D. 80 to 93; A. 64 to 75. Scales 90. Vert. 45. N. Atl., S. to N. Y. Southerly examples, subspecies **limandoides** (Bloch), have fewer rays (D. 80; A. 66); the typical form northward has D. 88 to 93; A. 70 to 75. (*Eu.*) (Lat., *platessa*, the plaice; Gr., *εἶδος*, like.)

201. PARALICHTHYS Girard (Bastard Halibuts) (Gr., παράλελλος, parallel; ἰχθύς, fish)

a. Gill rakers 5 + 16, rather long and slender; D. 85 to 93; A. 67 to 73.

363. **P. dentatus** (Linnaeus). Summer Flounder. Body ovate; maxillary half head; canines large. Brownish olive, always with many paler and darker spots and obscure ocelli. Head $3\frac{2}{3}$; depth $2\frac{1}{2}$. Scales 95. Vert. 40. L. $2\frac{1}{2}$ feet. Maine to Fla.; the common flounder N. (Lat., toothed.)

aa. Gill rakers few, 2 + 8 to 10, shortish.
b. Body ovate, opaque, the depth about $2\frac{1}{3}$ in length; no definitely placed ocelli.
c. D. 85 to 93; A. 65 to 73; scales about 100.

364. **P. lethostigma** Jordan & Gilbert. Southern Flounder. Eyes small, well separated. Dusky olive, nearly plain. Head $3\frac{3}{4}$. L. $2\frac{1}{2}$. N. Y. to Texas, the common flounder S. (Gr., λήθη, forgetting; στιγμή, spot.)

cc. D. 75 to 81; A. 59 to 61; lat. l. 95.

365. **P. albigutta** Jordan & Gilbert. Grayish brown, with many roundish pale blotches. L. 18. Va. to Texas; common S. (Lat., *albus*, white; *gutta*, spot.)

bb. Body oblong, strongly compressed, semi-translucent, side with 4 large oblong black ocelli, each edged with pinkish, the anterior spots just behind middle of body, the 4 forming a trapezoidal figure.

366. **P. oblongus** (Mitchill). Four-spotted Flounder. Mouth large. Head $3\frac{3}{4}$; depth $2\frac{1}{4}$. D. 77; A.62. Lat. l. 93. L. 18. Mass. Bay to N. J. (Lat., oblong.)

202. ANCYLOPSETTA Gill (Gr., ἄγκυλος, hook; ψῆττα, turbot)

367. **A. quadrocellata** Gill. Broadly ovate, the depth more than half the length; caudal fin with very short peduncle. D. 70 to 76; A. 57 to 59; pores 83 to 90; gill rakers 2 + 6 or 7. Vert. 35. Brownish, with 4 large ocellated spots. N. C. to Gulf of Mex. (Lat., four-eyed.)

Family LXXIII. PLEURONECTIDAE. (The Flounders)

Mouth small, with bluntish teeth; eyes always on the right side; otherwise essentially as in *Hippoglossidae*. Flounders of smaller size, all of the Northern seas.

a. Vert. in moderate number (36 to 44); D. 65 to 80; A. 45 to 60.
b. Teeth in 2 rows; lateral line not branched.
c. Lateral line with an arch in front; scales ctenoid. . . . . Limanda, 203.
cc. Lateral line without arch; teeth incisor-like.
d. Scales regularly imbricate, all on eyed side ctenoid in both sexes; lower pharyngeals very narrow, with slender teeth in 2 rows. . . . Pseudopleuronectes, 204.

dd. Scales imperfectly imbricate, rough-ctenoid in ♂, smoothish in ♀; lower pharyngeals very large, partly united, with blunt teeth in 5 or 6 rows.
LIOPSETTA, 205.

aa. Vert. in increased number (58 to 65); D. 100 or more; A. 70 to 100; teeth broad; left side of skull with large mucous cavities; anal spine strong; body elongate, compressed.
GLYPTOCEPHALUS, 206.

203. LIMANDA Gottsche (Old name)

368. **L. ferruginea** (Storer). YELLOW TAIL. Teeth conical, close-set, 11 + 30 in lower jaw; snout abruptly projecting, with an angle at its base; interocular ridge high and narrow, prolonged and rugose above opercle. Brownish, with rusty spots; blind side yellow. Head 4; depth 2⅛. D. 85; A. 62. Lat. l. 100. L. 2 feet. N. J. to Labrador. (Lat., rusty.)

204. PSEUDOPLEURONECTES Bleeker (Gr., ψευδής, false + *Pleuronectes*)

369. **P. americanus** (Walbaum). WINTER FLOUNDER. Body elliptical; interorbital space broad, convex, scaly; a low ridge above opercle. Dark rusty brown, obscurely mottled; fins plain. Head 4; depth 2¼. D. 65; A. 48. Lat. l. 83. L. 18. Labrador to Georgia; common.

370. **P. dignabilis** Kendall. LEMON SOLE. Near *P. americanus*, but the head shorter, the fin rays more numerous. Light brown, somewhat regularly blotched with blackish and whitish and washed with yellowish; the fins mostly shaded with orange. Head 4⅓ to 5; depth 2⅛. D. 68; A. 51. Scales 85. Georges Bank, off Cape Cod, Mass. (Lat., worthy.)

205. LIOPSETTA Gill (Gr., λεῖος, smooth; ψέττα, flounder)

371. **L. putnami** (Gill). EEL-BACK FLOUNDER. A coarse rugose ridge above opercle; scales in ♂ ctenoid on both sides, in ♀ mostly cycloid. Dark gray, mottled with darker; fins spotted. Head 3⅓; depth 2. D. 55; A. 40. Lat. l. 70. L. 12. (A species near the Alaskan *L. glacialis* Pallas.) R. I. to Labrador. (*Pleuronectes glaber* Storer, not of Rathke.) (Named for Frederick Ward Putnam.)

206. GLYPTOCEPHALUS Gottsche

(Gr., γλυπτός, sculptured; κεφαλή, head)

372. **G. cynoglossus** (Linnaeus). CRAIG FLUKE. Eyes large, 3 in head. P. short, not half head. Grayish brown; fins spotted. Head 5; depth 2¾. D. 107; A. 90. L. 15. N. Atl., S. to Delaware Bay. (An old name, from Gr., κύων, dog; γλῶσσα, tongue.)

FAMILY LXXIV. BOTHIDAE (THE TURBOTS)

Eyes and color on the left side; ventral fins not alike in form or position, the left ventral extended along the ridge of the abdomen. Species mostly of

tropical waters, many of them of quite small size. Certain European species, the Turbot (*Psetta*) and the Brill (*Bothus*), reach a large size and are important as food fishes. The Turbot, the largest and most valuable species, has a thick body covered with warty lumps instead of scales.

a. Body scaly; no hard tubercles on skin.
b. Vomer with teeth; lateral line arched in front; mouth large; teeth in bands; body broad-ovate; scales small, cycloid; interorbital space not concave. LOPHOPSETTA, 207.
bb. Vomer toothless; V. free from A.
c. Lateral line arched in front; teeth small, in 1 or 2 series; interorbital space concave, very broad in the adult; scales small, ctenoid. . . . . PLATOPHRYS, 208.
cc. Lateral line straightish; scales thin, deciduous.
d. Mouth moderate, the maxillary more than ⅓ head.
f. Teeth in upper jaw uniserial, the front ones scarcely enlarged; interorbital not broadened in male. . . . . CITHARICHTHYS, 209.
ff. Teeth in upper jaw biserial, the front ones enlarged; interorbital very broad in male. . . . . SYACIUM, 210.
dd. Mouth very small, the maxillary not ⅓ head; interorbital very narrow. ETROPUS, 211.

207. LOPHOPSETTA Gill

373. **L. maculatus** (Mitchill). WINDOW PANE. Body much compressed, translucent; first rays of D. much produced; scales cycloid, well developed. Grayish brown, profusely spotted and mottled with dark brown. Head 3¾; depth 1⅔. D. 65; A. 52. Lat. l. 100. L. 18. Gulf of St. Lawrence to S. C. A small and relatively valueless ally of the great turbot of Europe (*Psetta maxima*). (Lat., spotted.)

208. PLATOPHRYS Swainson (Gr., πλατύς, broad; ὀφρύς, eyebrow)

374. **P. ocellatus** (Agassiz). Interorbital very broad, especially in adult males, the pectoral being also lengthened. Maxillary 3¾ in head. Light grayish, with small round spots of darker gray and with lighter rings enclosing areas of ground color; 2 black blotches along lateral line; fins spotted; no blue markings. Head 4; depth 1⅓. D. 85 to 90; A. 65. Scales 72 to 78. L. 12. W. I. to Brazil, abundant S.; N. to L. I. (Lat., eyed.)

209. CITHARICHTHYS Bleeker (*Citharus*, an allied genus + Gr., ἰχθύς, fish)

375. **C. macrops** Dresel. WHIFF. Maxillary 2½ in head; eye moderate, 4; snout blunt, set out in profile. Head 4; depth scarcely 2. D. 80; A. 56. Lat. l. 41. N. C. to Gulf of Mex. (Gr., μακρός, large; ὤψ, eye.)

376. **C. spilopterus** Günther. WHIFF. Maxillary 2⅓ in head; eye small, 5 to 6; snout short, forming an angle with preorbital; teeth small, those in front larger. Head 3½; depth 2⅓. D. 75 to 80; A. 58 to 61. Lat. l. 43 to 45. L. 6. N. J. to Brazil. A little flounder, very common on sandy shores.

(Related species occur in deeper water, in the Gulf Stream.) (Gr., *σπίλος*, spot; *πτερόν*, fin.)

210. SYACIUM Ranzani (Gr., *συάκιον*, diminutive of pulse)

377. S. **papillosum** (Linnaeus). Scales rather large, 50 to 57 in lat. l. D. 82; A. 63 to 70. Interorbital broader than eye in male. Color nearly plain brown, with darker dots and mottlings but no ocelli. N. C. to Brazil. (Lat., having papillae.)

378. S. **micrurum** Ranzani. Scales rather small, 65 to 70. D. 87 to 92; A. 54 to 58. Interorbital narrower than eye in male. Dark brown, with rings and spots of light gray and blackish. N. C. to Brazil (Gr., *μικρός*, small; *οὐρά*, tail.)

211. ETROPUS Jordan & Gilbert (Gr., *ἦτρον*, abdomen; *πούς*, foot)

a. Body very deep, the depth more than half length.

379. E. **crossotus** Jordan & Gilbert. Maxillary 4 in head; eye $3\frac{3}{4}$. Olive-brown, with darker blotches; fins finely speckled. Head $4\frac{2}{5}$; depth $1\frac{4}{5}$ to 2. D. 76 to 85; A. 56 to 67. Scales 42 to 48. L. 5. Both coasts of Mexico and W. I., N. to Va. (Probably the West Indian form is distinct from E. *crossotus*, described from Mazattan.) (Gr., *κροσσοτός*, fringed.)

aa. Body more elongate, the depth less than half length.

380. E. **microstomus** (Gill). Maxillary $4\frac{1}{2}$; eye 3 to $3\frac{1}{2}$ in head. Grayish, with small dark blotches; 2 dark spots at base C.; fins speckled. Head 4; depth $2\frac{1}{4}$. D. 77 to 78; A. 57 to 61. Lat. l. 38 to 41. N. Y. to Fla.; scarce. (Gr., *μικρός*, small; *στόμα*, mouth.)

381. E. **micros** (Fowler). Body relatively slender, much compressed; eyes large, close together; maxillary oblique, $3\frac{1}{2}$ in head, extending to front of pupil; teeth minute, even, in 2 rows; dorsal beginning over front of lower eye. Sandy-gray; every sixth ray of dorsal and anal with a small oblong black spot at base. Head $3\frac{3}{5}$; depth $2\frac{1}{2}$. D. 67; A. 52; P. 16–10; V. 7–5. Scales 43. Gill rakers 2 + 6. Cape May Co., N. J. (Gr., *μικρός*, small; *ὦς*, mouth.)

Family LXXV. ACHIRIDAE (The Broad Soles)

Body deep, compressed; edge of preopercle concealed by the scales (if present); mouth very small, strongly twisted toward the left or blind side; the teeth rudimentary; eyes on the right, separated by a bony ridge; caudal fin free from dorsal and anal. Species chiefly American, separated from the true Soles (*Soleidae*) of Europe and Asia chiefly by the character of the ventral, that of the right side with a long base continued along the ridge of the abdo-

men and more or less fully joined to the anal; pectoral minute or wanting. In the *Soleidae* the ventral has a short base and is entirely free from the anal.

a. Gill openings moderate, confluent; scales ctenoid, those on head enlarged and fringed. ACHIRUS, 212.

aa. Gill openings reduced to small slits below opercle; no scales. . . GYMNACHIRUS, 213.

212. **ACHIRUS** Lacépède (Gr., ἀχείρ, without hands)

382. **A. fasciatus** Lacépède. BROAD SOLE. HOG-CHOKER. Eyed side without black hair-like cilia. Olive-brown, mottled and with about 8 dark vertical streaks; vertical fins with dark spots and clouds; belly with dark spots in N. examples. D. 50 to 55; A. 37 to 46. Lat. l. 66 to 75. Head 4; depth $1\frac{4}{5}$. L. 8. Cape Ann, S. to Texas; abundant S.; ascending rivers. (Lat., barred.)

213. **GYMNACHIRUS** Kaup (Gr., γυμνός, naked + *Achirus*)

383. **G. melas** Nichols. Pectoral fin reduced to one rudimentary ray. Body ovate. D. 65; A. 45. N. C. (Gr., μέλας, black.)

384. **G. nudus** Kaup. No pectoral fins. Body oval. D. 51, A. 42. Woods Hole to Brazil, rare N. (Lat., naked.)

FAMILY LXXVI. **CYNOGLOSSIDAE** (THE TONGUE FISHES)

This group, the most aberrant among the flatfishes, has the eyes on the left side, very small, with no ridge between them; dorsal and anal fins confluent in a pointed tail; scales ctenoid. Small soles, chiefly of tropical seas.

a. Ventral of left side only present, free from anal; no pectoral fin; no lateral line; head without fringes. . . . . SYMPHURUS, 214.

214. **SYMPHURUS** Rafinesque (*Plagusia* Cuvier; *Aphoristia* Kaup) (Gr., συμφύω, to grow together; οὐρά, tail)

385. **S. plagiusa** (Linnaeus). TONGUE FISH. Body broadly lanceolate. Brown, with faint darker longitudinal streaks and with black crossbars; C. similarly colored, never black. Head 5; depth 3 to $3\frac{1}{3}$. D. 86 to 95; A. 75 to 80. Lat. l. 85 to 93. Va. and Texas, S. to Brazil, on sandy shores. (An old name from Gr., πλάγιος, oblique.)

ORDER XXVII. **ACANTHOPTERI** (*Percomorphi*) (THE TYPICAL SPINY-RAYED FISHES)

This order contains the most of the spiny-rayed fishes, and includes a far greater variety of forms than any other of the so-called orders. In all, the ventrals, if present, are thoracic, jugular, or sometimes (*Percesoces*) subabdominal; gills normal, 4 in number, and the premaxillary forming the whole

border of the mouth. The anterior rays of D. and A. are normally simple or spine-like. The families in the series, which are here placed first, have the ventral fins subabdominal, detached from the shoulder girdle. This character, seemingly intermediate, may not be really such, as this group or suborder (*Percesoces*) may be a separate variant from perch-like forms, with which the *Percesoces* agree in general in most other traits.

Suborder PERCESOCES

Family LXXVII. MUGILIDAE (The Mullets)

Body oblong, with large cycloid scales; no lateral line; mouth small, nearly toothless, or with flexible cilia; upper jaw protractile; gill membranes free from isthmus; gill rakers long, slender; pseudobranchiae large. Dorsals separate, the anterior with 4 spines; anal similar to soft dorsal, with 3 spines. Ventrals subabdominal, I, 5. Air bladder large; intestinal canal long; vertebrae 11 + 13 = 24. Species numerous; in estuaries and river mouths of warm regions, feeding on mud.

a. Teeth flexible, ciliiform.
b. Adipose eyelid well developed.
c. Soft dorsal and anal nearly or quite scaleless; each jaw with a few series of flexible teeth; scales moderate. . . . . Mugil, 215.
cc. Soft dorsal and anal densely scaled. . . . . Querimana, 216.

215. MUGIL (Artedi) Linnaeus (Striped Mullets) (Ancient name, from *mulgeo*, to suck)

386. **M. cephalus** Linnaeus. Striped Mullet. Common Mullet. Silvery, darker above; dark stripes along the rows of scales; a dusky blotch on base of P. Dorsal and anal scaleless. Head 4; depth 4. D. IV–I, 8. A. III, 8. Scales 40–13. L. 24. Warm seas; a bay fish; common N. to Maine, ascending streams. Among the various striped mullets of the world, I have thus far failed to find distinctions. The list includes *M. albula* L., from Charleston; *M. rammelsbergi* Tschudi, from Peru; *M. tang* Bloch, from Africa; *M. oeur* Forskål, from the Red Sea; and *M. mexicanus* Steindachner, from Acapulco. In case specific distinctions are found, our American form stands as *M. albula*. (*Eu.*) (An old name, from Gr., κεφαλή, head.)

216. QUERIMANA Jordan & Gilbert (White Mullets) (*Queriman*, Portuguese name of *Q. curema*)

387. **Q. curema** (Cuvier & Valenciennes). White Mullet. Liza Blanca. Blueback Mullet. Queriman. Silvery without dark streaks; a dark spot at base of P. Pectoral not nearly reaching D. Head 4; depth 4. D. IV–I, 8. A. III, 9. Scales 38–12. L. 18. Tropical America, N. to Cape Cod, rare N., except as young. (A Brazilian name.)

Note. This and at least some other species of mullets pass through a pelagic juvenile stage, so unlike the adult as to have been classed in a different genius, *Querimana* — a name which I now adopt for one of the genera of mullets. These young are brilliant green or blue above, and silvery on the sides. They have but two anal spines (the first soft ray becomes transformed into the third spine of the adult). They swarm at the surface in the Tropics, so much so as to have won the name of "whirligig mullets." The young of *Q. curema*, earlier known as *Querimana harengus* (Günther) are common N. to Woods Hole.

Family LXXVIII. ATHERINIDAE (The Silversides)

Body elongate, compressed, with cycloid scales; no lateral line; mouth moderate; teeth small, fixed; opercles unarmed; gill membranes free; pseudobranchiae present; gill rakers slender. Dorsals well separated, the first of 3 to 8 slender spines; A. similar to soft D., with one spine; V. abdominal I, 5; air bladder present; vertebrae numerous. Fishes of moderate or small size, living in schools in shallow waters, along coasts of warm regions, many in lakes or rivers; those within our limits are small, but many others are of large size and valued as food.

a. Premaxillaries freely protractile, their posterior end broad; teeth in bands; none on vomer; a silvery band along side.
b. Jaws both short, the upper scarcely longer than eye; species mostly marine.
c. Scales with entire edges; dorsal and anal scaleless. . . . . Menidia, 217.
cc. Scales laciniate; dorsal and anal fins closely scaly. . . . . Membras, 218.
bb. Jaws both produced in a short beak, the upper about half longer than eye; scales smooth. Dainty brook fishes. . . . . Labidesthes, 219.

217. MENIDIA Bonaparte (An old name, from Gr., μήνη, moon)

a. Anal rather long, its rays I, 22, to I, 25.

388. **M. notata** (Mitchill). Common Silverside. Friar. Body slender; transparent green; scales speckled. Head 5; depth 6. D. IV–I, 8. A. I, 23. Scales 46–10. L. 5. Nova Scotia to Va., very common N. (Lat., marked.)

389. **M. menidia** (Linnaeus). Stouter; head $4\frac{2}{5}$; depth 5. Scales 40. Back much dotted; lateral streak narrower. Va. to Fla., representing the slender Silverside S.

aa. Anal rather short, I, 15, to I, 19.

390. **M. beryllina** (Cope). First D. over vent, nearer base C. than snout. Head $4\frac{1}{4}$; depth $5\frac{1}{3}$; eye 3; A. I, 16 or I, 17. Scales 39; color very pale, scarcely dotted. L. $2\frac{1}{2}$. Cape Cod and S. (Lat., emerald-color.)

218. MEMBRAS[1] Bonaparte (Gr., μεμβάς, the name of some fish)

(*Kirtlandia* Jordan & Evermann)

[1] The type of *Membras* (*martinica*) is said to have the dorsal and anal scaleless. The northern forms (*vagrans* and *laciniata*) have therefore been set off as *Kirtlandia*, and the character in question is doubtful.

391. **M. laciniata** (Swain). Rough Silverside. Green; a broad silvery band; back with dark points forming streaks along rows of scales. Head $4\frac{3}{4}$; depth $5\frac{1}{2}$. D. IV–I, 8. A. I, 19 to I, 21. Scales 50–7, with ragged edges. L. 5. N. Y. to S. C. Represented S. by **M. l. vagrans** Goode & Bean, found from S. C. to Texas, has A. I, 14 to I, 17; scales 45. (Lat., gashed.)

219. LABIDESTHES Cope (Gr., λαβίς, a pair of forceps; ἐσθέω, to eat)

392. **L. sicculus** Cope. Brook Silverside. Translucent green, back dotted; silver band very distinct; body very slender; scales entire. Head $4\frac{1}{2}$; depth 6. D. IV–I, 11. A. I, 23. Scales 75. L. $3\frac{1}{2}$. Mich. to Florida and Okla., abundant in quiet waters. A most graceful little fish. (Lat., dry; i.e., found in drying pools.)

Family LXXIX. SPHYRAENIDAE (The Barracudas)

Body elongate, subterete, with small, cycloid scales. Head very long, pointed; mouth large, with unequal teeth, some of them very large; lower jaw projecting, a very strong tooth at tip; gill rakers obsolete; gill openings wide; lateral line present; air bladder large; P. short; V. abdominal, I, 5. Dorsals separate, the first with 5 stout spines; A. with one spine; C. forked; vertebrae 24. One genus with 15 species. Voracious, pike-like fishes of warm seas, some of them of great size, all excellent as food.

220. SPHYRAENA (Artedi) Röse (Ancient name, from Gr., σφῦρα, hammer)

a. Scales small, 130 to 150 in lateral line.

393. **S. borealis** De Kay. Little Barracuda. Olivaceous, silvery below; young with dusky blotches; P. not nearly reaching D.; maxillary not nearly to eye. Head 3; depth 8. D. V–I, 9. A. I, 9. L. 12. Cape Cod to Cape Fear, not rare N.; smallest of the Barracudas, of which certain species in the tropics reach a very great size, 6 feet or more. (Lat., northern.)

aa. Scales moderate, about 110 in lateral line.

394. **S. guachancho** Cuvier & Valenciennes. P. about reaching spinous D. Head $3\frac{1}{4}$; depth 7. D. V–I, 9. A. I, 8. L. 24. West Indies, rarely N. in the Gulf Stream to Woods Hole. (The Spanish name.)

aaa. Scales large, 75 to 85 in lateral line. (*Agriosphyraena* Fowler.)

395. **S. barracuda** (Walbaum). Great Barracuda. Silvery, the young with dark blotches; some inky spots; soft D., A. and V. black, except in margins. D. V–I, 9; A. I, 9. L. 6 ft. Very large and voracious. Woods Hole to Brazil, rare N. of S. C. (The Spanish name.)

Family LXXX. POLYNEMIDAE (The Threadfins)

Species numerous in the tropics; at once known by the pectoral filaments.

221. POLYNEMUS Linnaeus (Gr., πολύς, many; νῆμα, thread)

396. P. octonemus Girard. Threadfin. Pectoral filaments 8. D. VIII–I, 12 or 13; A. III, 13 to 15; scales 6–70–10. Light olivaceous, tinged with dark punctulations; pectoral black in adult. Woods Hole to Rio Grande; rare N. (Gr., ὀκτώ, eight; νῆμα, thread.)

Suborder SCOMBRIFORMES

We now begin the great group of *Scombriformes*, or mackerel-like fishes, with the most aberrant of its living members.

Family LXXXI. ISTIOPHORIDAE (The Sailfishes)

Fishes resembling the Swordfishes, but with rudimentary scales, small persistent teeth, and slender ventral fins of 1 or 2 rays; spear long, more slender than in the Swordfishes; gills reticulate as in *Xiphias;* air bladder sacculated; spines of fins distinct, not embedded in skin. Vertebrae 24, elongate, hour-glass-shaped; ribs well developed. Species pelagic, some of them larger than the Swordfish, but similar in character and habits. Among them are the swiftest of all fishes.

a. Dorsal fin very high, its median rays higher than the anterior lobe, greater than depth of body; ventrals longer than pectorals, of 2 or 3 rays. . . . . Istiophorus, 222.
aa. Dorsal fin with the spines progressively lower behind the higher anterior lobe; ventrals shorter than pectorals, the rays united into one. . . . . Makaira, 223

222. ISTIOPHORUS Lacépède (Sailfishes)

(Gr., ἱστίον, sail; φορέω, to bear)

397. I. americanus Cuvier & Valenciennes. American Sailfish. Dorsal fin very high, deep blue with many round black spots; color blue-black, nearly uniform; about a dozen short, stublike spines on the back of the caudal peduncle between the two dorsals. Spear $2\frac{2}{5}$ times rest of head. Head $2\frac{3}{5}$; depth 6. D. XLI. L. 8 feet. West Indies to Brazil, N. in the Gulf Stream to Cape Cod.

398. I. volador Jordan & Evermann. Florida Sailfish. Volador. Body rather slender, the dorsal high, its spots rather fewer; back of caudal peduncle naked between dorsals, without short spines or stubs. Side of back with a row, more or less irregular, of round pale spots. West Indies, N. in the Gulf Stream; the most abundant species off Florida. One of the swiftest of all fishes. (Spanish, flyer.)

223. MAKAIRA Lacépède (Marlinspike Fishes) (Gr., μαχαίρα, a dagger)

399. **M. albida** (Poey). Spearfish. Billfish. Marlinspike Fish. Body rather slender, steel blue, without bluish crossbars; dorsal lobe $1\frac{1}{4}$ in pectoral, $1\frac{3}{4}$ in depth; pectoral $1\frac{1}{4}$ in head to tip of lower jaw. Head $3\frac{2}{5}$, including spear. D. XXXIX. Weight reaching 800 pounds. West Indies, N. at times to Cape Cod. (The old-world genus, *Tetrapturus*, has the anterior spines low, and the posterior part of the fin moderately elevated so that the outline of the fin is somewhat undulate, not concave as in *Makaira*.) Various other species of *Makaira* occur in the tropics, some reaching a weight of 1500 lb. (Lat., whitish.)

Family LXXXII. XIPHIIDAE (The Swordfishes)

Body elongate, naked; bones of upper jaw consolidated into a long, stiff "sword," broader than in any spearfish or sailfish; teeth disappearing with age; D. without distinct spines, the rays enveloped in the skin; the fin divided with age into two fins, the first high, the second small, the intervening rays aborted in the adult; A. similarly divided; tail slender, keeled; C. widely forked; V. wanting. Gills peculiar, the laminae of each arch joined in one plate by reticulations; air bladder simple; pyloric caeca numerous. Vertebrae 26, short, the neural and haemal spines normal; ribs very few. One species, a very large fish of the open sea, much valued as food.

224. XIPHIAS Linnaeus (Gr., ξιφίας, ancient name, from ξίφος, sword)

400. **X. gladius** Linnaeus. Swordfish. Broadbill. Dark bluish. Head $2\frac{1}{4}$; depth $5\frac{1}{2}$; snout $3\frac{1}{2}$. D. 40–4. A. 18–14. L. 15 feet or more. Weight of adult 500 to 600 lb. In all warm and temperate seas, N. to England and Nova Scotia. (*Eu.*) (Lat., sword.)

Family LXXXIII. TRICHIURIDAE (The Scabbard Fishes)

Fishes closely related to the *Scombridae*, but having the vertebrae very numerous, and the dorsal fin long and low, its spines and soft rays indistinguishable from each other, and having no finlets. Ventral fins rudimentary or wanting. Caudal fins small, or wanting. Species few, surface swimmers in the warm seas.

a. No caudal fin; tail tapering to a point; no ventrals; teeth very strong, unequal, some of them barbed. . . . . Trichiurus, 225.

225. TRICHIURUS Linnaeus (Gr., τριχίον, a little hair; οὐρά, tail)

401. **T. lepturus** Linnaeus. Scabbard Fish. Cutlass Fish. Silver Eel. Silvery, D. dark-edged; snout long; lower jaw longer. Head $7\frac{1}{2}$;

depth 16. D. 135. A. very low, 100. Warm seas, N. to Mass. (Gr., λεπτός, thin; οὐρά, tail.)

Family LXXXIV. SCOMBRIDAE (The True Mackerels)

Body subfusiform, tapering to a slender tail with a strong, forked caudal fin; scales small, cycloid; not enlarged anteriorly to form a "corselet"; lateral line present; two small keels on caudal peduncle, the median keel wanting. Head pointed, mouth large; premaxillaries not protractile; teeth sharp, even, rather small; opercles unarmed; gill openings very wide; pseudobranchiae large; gill rakers moderate; vertebrae about 31, none of them modified into "trellis form." Dorsal fins well separated, the first short, of 8 to 12 slender spines. Ventrals thoracic, I, 5. Pyloric caeca many. Gill rakers numerous. Sexes similar. Coloration metallic blue-brown, sometimes with stripes. Fishes of the high seas, valued as food, though the oily flesh is sometimes not easily digested. The species (as the family is now restricted) are few in number and are migratory in large schools.

a. Air bladder obsolete; dorsal spines 11 or 12. . . . . Scomber, 226.
aa. Air bladder well developed; dorsal spines 8 to 10; top of head with a translucent area. Pneumatophorus, 227.

226. SCOMBER Linnaeus (Mackerels) (Lat.)

402. **S. scombrus** Linnaeus. Common Mackerel. Dark blue above, plain silvery below; back with about 30 dark wavy stripes. Eye moderate. Head 3; depth 3½. D. XI–12–V. A. 12–V. L. 2 feet. Atl., in great schools, everywhere abundant in season of migration. One of the best known and most valuable of food fishes. (Gr., σκόμβρος, Scomber, mackerel.)

227. PNEUMATOPHORUS Jordan & Gilbert (Chub Mackerels) (Gr., πνεῦμα, air bladder; φορέω, to bear)

403. **P. grex** (Mitchill). Chub Mackerel. Thimble-eye. Dark blue above, sides soiled silvery, the adult showing dusky cloudings; back with about 30 dark wavy streaks, extending from just below lateral line; eye large. Head 3; depth 3. D. IX–13–V. A. 12–V. L. 12. N. Atl. coast of U. S., common. Much smaller than the common mackerel, hence much less valued. It is represented in most other seas by closely related, hardly distinguishable forms (*P. colias* (Gmelin) in the S. of Europe, *P. diego* in California, and *P. japonicus* in Japan). If all are regarded as one species, the name *japonicus* must be retained as the oldest. (Lat., gregarious.)

Family LXXXV. CYBIIDAE (The Spanish Mackerels)

Mackerels with the body scaly, without distinct corselet; the spinous dorsal many-rayed, the soft dorsal inserted close behind it; dorsal and anal

followed by numerous finlets; ventrals thoracic, I, 5; body long, compressed; caudal peduncle with 3 keels, the median strongest; teeth long, usually subtriangular and compressed; villiform teeth on vomer and palatines; gill rakers few or many (but one in *Cybium*, an Asiatic genus), rather short. Species many, in most warm seas. This is the most primitive of the mackerel-like fishes; numerous fossil genera abounding in the Miocene period, some of them remarkable for long and slender parallel interhaemal bones.

a. Gill rakers short and thick, about 8 on lower limb of arch. . . . . . Sierra, 228.
aa. Gill rakers slender, about 15 on lower limb; interhaemal bones long, parallel. Scomberomorus, 229.

228. SIERRA Fowler (Spanish name, from *sierra*, a saw)

404. S. **cavalla**[1] (Cuvier). Kingfish. King Mackerel. Lateral line abruptly bent below soft D. Gill rakers few, short and thick. Iron-gray, nearly plain; spinous D. not black. Head 5; depth 6. D. XV–15–VIII. A. II–15–VIII. L. 6 feet. W. Indies, rarely N. A fine food fish. (Spanish, horse.)

229. SCOMBEROMORUS Lacépède (Spanish Mackerels)

a. Sides with one or two narrow blackish stripes breaking up posteriorly into irregular spots; similar spots usually present below these.

405. S. **regalis** (Bloch). Sierra. Pintado. Teeth 40, in each jaw; snout bluntish. Head $4\frac{1}{4}$; depth $4\frac{1}{2}$. D. XVIII–16–VIII. A. II–14–VIII. L. $2\frac{1}{2}$ feet. W. Indies, rarely N. (Lat., kingly.)

aa. Sides with numerous round bronze spots, but never with dark longitudinal stripe.

406. S. **maculatus** (Mitchill). Spanish Mackerel. Bluish above, sides silvery; spinous dorsal largely black; teeth about 30 in each jaw; snout pointed. Gill rakers long and slender, about 17 below arch; lateral line wavy, not abruptly bent. Head $4\frac{2}{3}$; depth 5. D. XVIII–17–X. A. II, 18–VIII. L. $2\frac{1}{2}$ feet. West Indies, N. in summer. A favorite food fish. (Lat., spotted.)

Family LXXXVI. THUNNIDAE (The Tunnies and Bonitos)

Mackerels, often of heroic size, the body with small smooth scales at least anteriorly, those of the shoulder larger, forming a corselet, teeth of jaws subconic, not compressed; gill rakers numerous, rather long; spinous dorsal long, the second dorsal usually close behind it; ventrals thoracic, 1, 5; finlets well developed. Large fishes, mostly of the high seas, the flesh rather coarse but often valued as condiment. Species relatively few, but the number of individuals sometimes inordinately great.

[1] Allied to *Sierra cavalla* is the large *Peto* or *Wahoo* of the West Indies, *Acanthocybium petus* (Poey), often taken off Florida by anglers. This huge game fish reaches a length of 8 feet and a weight of 100 lb.

a. Posterior abdominal vertebrae like the others, not modified as a "trellis"; spinous dorsal long and not distant from its soft rays.
b. Vomer toothless; palatines with one row of strong conical teeth; vertebrae about 52; body with black stripes. (*Sardinae.*) . . . . . SARDA, 230.
bb. Vomer and palatines with sand-like teeth; body robust; vertebrae about 40; pectoral fin relatively short, not reaching nearly to anal; size enormous. (*Thunninae.*)
c. Pectoral fin normally short . . . . . THUNNUS, 231.
cc. Pectoral fin very long, almost ribbon-like . . . . . GERMO, 232.
aa. Posterior abdominal vertebrae with a "trellis-like" structure, connecting each vertebra, across a large foramen, with its haemapophyses; body posteriorly scaleless.
d. Dorsals close together, the interspace about 5 in head, the spines about 15 in number. (*Katsuwoninae.*)
e. Lateral line nearly straight; no black stripes on sides below it; sides of breast in adult with a few large black spots. . . . . EUTHYNNUS, 234.
ee. Lateral line with a strong curve; sides of body with about 6 conspicuous black curved stripes. . . . . KATSUWONUS, 233.
dd. Dorsal fins well separated, the interspace more than half head, the spines 10 in number; teeth on vomer, none on palatines; gill rakers numerous. (*Auxinae*). AUXIS, 235.

230. SARDA Cuvier (Lat. name, from Sardinia, where it abounds)

407. **S. sarda** (Bloch). BONITO. Steel-blue, with several black stripes obliquely downward and forward from back. Head $3\frac{3}{4}$; depth $4\frac{1}{3}$. D. XXI–I, 13–VII. A. II–13–VII. L. 4 feet. Atl., abundant N. to Maine. (*Eu.*)

231. THUNNUS South (TUNNY) (Gr., *θύννος*, tunny)

(*Orcynus* and *Thynnus* Cuvier, both names preoccupied, *Albacora* Jordan)

408. **T. thynnus** (Linnaeus). GREAT TUNNY. TUNA. HORSE MACKEREL. Very robust. Dark blue, dusky below, with obscure paler spots, forming pale waves or cross-streaks in the young; finlets bluish. Head $3\frac{3}{4}$; depth 4. D. XIV–I, 12–VIII. A. II–12–VIII. L. 12 to 15 feet. Atl., everywhere (if all forms are really one species). One of the largest of fishes, sometimes reaching 1600 lb. Highly valued by deep-sea anglers. The flesh is red and rather coarse. (The form along our Atlantic coast N. has been called subsp. **secundodorsalis** Storer. In this form the anal fin is (always?) inserted farther back, under the second dorsal finlet.) (*Eu.*)

232. GERMO Jordan (French, Germon)

409. **G. alalunga** (Gmelin). ALBACORE. LONG-FINNED ALBACORE. Dark blue; finlets bluish — probably never yellow; head $3\frac{1}{4}$; depth $3\frac{1}{2}$; D. XIV-I, 12, VIII. A. II, 12, VII. L. 3 to 5 feet. Weight 25 to 65 lb. Tropical Atl., on both shores, rare N. (*Eu.*) Remarkable for its very long, almost ribbon-like pectorals, which reach well along the dorsal fin, about to the second finlet. A valued game fish, the flesh pale and well flavored. Along with *Thunnus*, *Katsuwonus*, and related forms, it is put up in cans as "tuna" and used for condiment. (*Alalunga* = long-wing, a vernacular name for the species in Sardinia.)

233. KATSUWONUS Kishinouye. (From *Katsuwo*, the Japanese name)

410. **K. pelamis** (Linnaeus). Oceanic Bonito. Aku. Katsuwo (Victor Fish). Body plump. Color dark blue with 4 to 5 curved dark stripes on each side of belly, some pale marblings on side of back. Lateral line behind second dorsal abruptly curved. Pectoral very short, about equal to dorsal spines. Head $2\frac{1}{3}$; depth 4; D. XV–12–VIII. A. 12–VII. L. 3 to 4 feet. Warm parts of the Atl. A closely related species (*K. vagrans* Lesson), perhaps the same, is inordinately abundant from southern California to Japan, especially about Hawaii, swimming in prodigious schools and spawning in the open sea. (Gr., πελαμύς, the Bonito, *Sarda*.)

234. EUTHYNNUS Lütken (Gr., εὖ, well; θύννος, tunny)

411. **E. alletteratus** (Rafinesque). Little Bonito. Alletterato. Kawakawa. Bluish; no stripes on lower parts; several oblique, wavy dark streaks above lateral line, about 5 large dark spots below P. (these sometimes wanting). Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. XV–12–VIII. A. 12–VII. L. $2\frac{1}{2}$ feet. Warm seas, rarely seen on our coasts, breeding near shore in the tropics. The Pacific form, as in *Katsuwonus*, may be distinct from the European. (From *alletterato*, the Sicilian name.)

235. AUXIS Cuvier (Gr., αὐξίς, a young tunny)

412. **A rochei** Risso. Frigate Mackerel. Tassard. Bluish brown, somewhat mottled with darker. Head 4; depth $4\frac{1}{4}$; D. X–12–VIII. A. 13–VII. L. 18. Warm seas, wandering in schools very irregularly, occasional on our Atlantic coast. (*Eu.*) This species may not be different from *Auxis thazard* of the South seas. (Named for de la Roche, a French naturalist.)

Family LXXXVII. CARANGIDAE (The Pampanos)

Fishes allied to the Mackerels, but with the vertebrae in normal number, about 24; finlets usually few or none. Teeth moderate or small, sometimes lost with age. Boundary of body cavity formed by coössified bones made up of haemals and interhaemals, somewhat as in flounders; soft dorsal and anal subequal, the base of the latter longer than abdomen; anal with 2 free spines which are usually absorbed with age; spinous dorsal fin sometimes also obliterated. Coloration metallic silvery. Species numerous; in all warm seas; most of them excellent as food.

a. Premaxillaries not protractile (except in the very young); soft dorsal similar to anal, both very long. (*Scombroidinae*.)

b. Maxillary without supplemental bone; no pterygoid teeth; scales linear, imbedded.
Oligoplites, 236.

aa. Premaxillaries protractile.
c. Pectoral fins long, falcate; anal similar to soft dorsal, its base longer than abdomen; maxillary with supplemental bone. (*Caranginae.*)
d. Ventral outline not more curved than dorsal.
e. D. and A. each with one free finlet; body slender. . . . . DECAPTERUS, 237.
ee. D. and A. without finlets.
f. Lateral line with well developed scutes for its entire length. TRACHURUS, 238.
ff. Lateral line with scutes on its straight posterior portion only (these sometimes few and small in species with the body compressed.)
g. Shoulder girdle with a deep cross-furrow at its junction with the isthmus; body oblong, not elevated. . . . . TRACHUROPS, 239.
gg. Shoulder girdle of the usual form without cross-furrow; anterior rays of soft dorsal and anal elevated.
h. Teeth more or less unequal, the outer enlarged.
i. Maxillary very narrow, scarcely $\frac{1}{4}$ as wide as eye; teeth minute or obsolete in palatines. . . . . HEMICARANX, 240.
ii. Maxillary broad; teeth developed in vomer and palatine. CARANX, 241.
hh. Teeth equally small, in villiform bands; body very high and compressed, the depth about half the length; scutes small, spinous dorsal feeble, soon lost.
j. Soft rays of dorsal and anal much elevated anteriorly, more or less filamentous. . . . . ALECTIS, 242.
jj. Soft fins all very low, without filaments. . . . . VOMER, 243.
fff. Lateral line without scutes anywhere; body elevated, strongly compressed, soft rays of dorsal and anal much produced. . . . . ARGYREIOSUS, 244.
dd. Dorsal outline much less strongly curved than ventral; body compressed, with trenchant outlines, no scutes on lateral line. (*Chloroscombrinae.*) CHLOROSCOMBRUS, 245.
cc. Pectoral fins short, not falcate.
k. Maxillary without supplemental bone; anal similar to soft dorsal; its base much longer than abdomen; tail unarmed. (*Trachinotinae.*)
l. Forehead convex; teeth small, lost with age; membrane of spinous dorsal disappearing with age. . . . . TRACHINOTUS, 246.

236. OLIGOPLITES Gill (Gr., ὀλιγός, few; ὁπλίτης, armed)

413. **O. saurus** (Bloch & Schneider). LEATHERJACKET. RUNNER. Bluish, silvery below; fins yellow. Body lanceolate; fins low. Head 5; depth 4. D. V–I, 20. A. II–I, 20. L. 18. Warm seas; rarely N. (Gr., σαῦρος, old name of some fish that skips like a lizard.)

237. DECAPTERUS Bleeker (Gr., δέκα, ten; πτερόν, fin)

a. Scutes about 40; teeth present.

414. **D. punctatus** (Agassiz). SCAD. CIGAR FISH. ROUND ROBIN. Bluish; a dark opercular spot; about twelve small black spots on lateral line anteriorly. Head $4\frac{1}{3}$; depth 5. D. VIII–I, 30–I. A. II–I, 24–I. L. 12. W. I., etc.; occasional N.; common S. (Lat., dotted.)

aa. Scutes about 25; teeth obsolete.

415. **D. macarellus** (Cuvier & Valenciennes). MACKEREL SCAD. Lateral line unspotted; D. soft rays 33. A. 27; depth $5\frac{3}{4}$. W. I., rarely N. (French, *maquereau*, mackerel.)

238. TRACHURUS Rafinesque (ancient name, from Gr., *τραχύς*, rough; *οὐρά*, tail)

416. **T. lathami** Nichols. Rough Scad. Horse Mackerel. Saurel. Scutes all large, about 72 (35 + 37) in number; depth about 4. D. VIII–I, 29. A. II–1, 28. L. 12. West Indies, occasional on our coast, N. to Woods Hole. (To Mr. Roy Latham.)

239. TRACHUROPS Gill (*Trachurus*, name of a genus of fishes + Gr., *ὤψ*, appearance)

417. **T. crumenophthalmus** (Bloch). Big-eyed Scad. Chicharro. Goggler. Eye very large, 3 in head, with very large adipose eyelid; scutes 40. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. VIII–I, 26. A. II–I, 22. L. 12. Warm seas. N. to Cape Cod. (Lat., *crumena*, purse; Gr., *ὀφθαλμός*, eye.)

240. HEMICARANX Bleeker (Gr., *ἥμι*, half + *Caranx*)

418. **H. amblyrhynchus** (Cuvier & Valenciennes). Arch of lateral line very strong, its height more than $\frac{1}{3}$ its length. Caudal lobes very unequal. Head small, $4\frac{1}{3}$. Greenish above; C. yellow; base of P. merely dusky; a black axillary spot. N. C. to Brazil. (Gr., *ἀμβλύς*, blunt; *ῥύγχος*, snout.)

241. CARANX Lacépède (French *Carangue*)

a. Soft D. and A. only slightly elevated in front; D. 27; A. 23; teeth in narrow bands, without canines. (*Elaphotoxon* Fowler).

b. Depth 2.8; straight part of lateral line as long as curved part; gill rakers 17 to 19 on lower limb of outer arch.

419. **C. bartholomaei** Cuvier & Valenciennes. Yellow Jack. Head 3. Eye shorter than snout. Pectoral a little shorter than head. Bluish silvery, suffused with gold; fins pale yellow. W. I., rare N. to Woods Hole. (For St. Bartholomew Id.)

bb. Depth 3.5; straight part of lateral line much longer than curved part. Dark, without gold; gill rakers 31 to 33 on lower limb of outer arch.

420. **C. ruber** (Bloch). Crevallé. Head 3.5. Eye less than 4; snout more than $3\frac{1}{3}$. D. yellowish; C. with a blackish bar on lower lobe; other fins plain. W. I., very rarely N. to N. C. (Lat., red.)

aa. Soft D. and A. much elevated in front, with fewer fin rays.

c. Body subfusiform, the depth less than $\frac{1}{3}$ the length; breast scaly; no canines; scutes numerous, 40 to 50. (*Paratractus* Gill.)

421. **C. crysos** (Mitchill). Hardtail. Yellow Mackerel. Cocinera. Greenish, yellow below; a black blotch on opercle; none on P. Breast scaly; arch of lateral line about half straight part. Head $3\frac{3}{4}$; depth $3\frac{1}{4}$. D. VIII–I,

24. A. II, 1, 19. Scutes 50. L. 18. Mass. Bay and S., rather common. (Gr., χρυσός, gold.)

cc. Body oblong-ovate, the depth more than ⅓ the length; outer teeth longer.
d. Breast entirely scaly. (*Carangulus*, Jordan & Evermann.)

422. C. latus Agassiz. Jurel. Xurel. Horse-eyed Jack. Pectoral spot usually wanting, opercular spot conspicuous; lower jaw without distinct canines. Head 3⅖; depth 2¾. D. VIII–I, 22. A. II–1, 16. Scutes, 30. L. 18. Tropical Atl., rarely N. (Lat., broad.)

dd. Breast naked, except a small rhombic scaly area before V.; lower jaw with two small canines. (*Caranx.*)

423. C. hippos (Linnaeus). Jack. Crevallé. Cavalla. Toro. Jiguagua. Head large and deep, especially in adult, mouth large; adult with a large black spot on opercle and one near base of P. Head 3¼; depth 2½ to 3. D. VIII–1, 20. A. II–1, 17. Scutes 25. L. 36. Warm seas, N. to Cape Cod; common S. (Gr., ἵππος, horse.)

242. ALECTIS Rafinesque (Gr., αλήκτις, cock)

424. A. crinitus (Mitchill). Threadfish. Cobbler fish. Body very deep, broadly ovate, its edges trenchant; scales minute; scutes very feeble, Silvery, darker above; a dark blotch on opercle. Teeth of jaws equally small; breast naked, spinous dorsal disappearing with age; soft dorsal and anal with 3 to 6 anterior rays produced in long filaments. Head 3; depth 2 (young as deep as long). D. VI–1, 19. A. 16. Scutes 9 to 12. L. 2 feet. Warm seas, N. to Woods Hole. The American fish is not clearly distinct from *A. ciliaris* (Bloch) of the Pacific. The changes with growth in *Alectis*, *Vomer*, and *Argyreiosus* are very great, the body in the adult being more elongate, and the filaments much shorter than in the young. (Lat., *crinitus*, with hairs or filaments.)

243. VOMER Cuvier (Lat., a ploughshare)

425. V. setapinnis (Mitchill). Horsefish. Bluntnose Shiner. Body oblong, excessively compressed, but less elevated than in *Alectis* or in *Argyreiosus;* fins in adult all very low, rays filamentous; head very gibbous above eye; scutes minute. Head 3¼; depth 2 (deeper in young). D. VIII–I, 21 to 25; A. II–I, 18 to 20. L. 18. W. I., N. to Nova Scotia, common. (Lat., *seta*, bristle; *pinna*, fin.)

244. ARGYREIOSUS[1] Lacépède (Gr., ἀργύρεος, silver)
(*Selene* Lacépède)

a. D. with 22 soft rays; A. with about 18; anterior profile of head from base of snout to occiput almost straight, the bones of the head being much distorted.

[1] Cuvier was first to show that *Selene* was the adult of *Argyreiosus*. He chose the latter name in preference to the page priority of *Selene*.

426. **A. vomer** (Linnaeus). Moonfish. Horsehead. Look-down. Jorobado. Adult with soft rays of D. and A. much produced; young with dorsal spines and V. variously elongate, these fins becoming short with age. Silvery. Head 3; depth 1½. L. 12. W. I., frequently N. to Cape Cod. (Lat., a ploughshare.)

245. CHLOROSCOMBRUS Girard (Gr., χλωρός, green; σκόμβρος, mackerel)

427. **C. chrysurus** (Linnaeus). Bumper. Casabe. Xurel de Castilla. Greenish; sides and below golden; a dark blotch on back of tail. Head deep; mouth very oblique; P. very long; chord of arch of lateral line 1¾ in straight part; no scutes. Head 3¾; depth 2⅓. D. VIII–I, 26. A. II–I, 26. L. 9. W. I., rare N. (Gr., χρυσός, gold; οὐρά, tail.)

246. TRACHINOTUS Lacépède (Pampanos) (Gr., τραχύς, rough; νῶτος back)

a. Dorsal with 19 or 20 soft rays; anal with 17 to 19. Dorsal and anal lobes very high.
b. Body broadly ovate, its depth at all ages more than half the body.
c. Sides with conspicuous black bars.

428. **T. palometa** Regan. Gaff-topsail Pampano. Palometa. Oldwife. Body deep, profile convex, lobes of dorsal and anal high, in adult reaching middle of caudal. Color bluish, crossed by 4 black vertical bands; a black spot on lateral line below last rays of dorsal. Head 4. Depth 2. D. VI–I, 19. A. II–I, 18. Va. to Caribbean Sea, common S. A handsome fish, but not highly regarded as food. (*T. glaucus* Bloch, but the earlier name of *Lichia glauca* is regarded by Regan as also a *Trachinotus*.) (The Spanish name.)

cc. Sides without black crossbars.

429. **T. falcatus** (Linnaeus). Round Pampano. Palometa. Body deep, compressed, profile evenly convex; no dark crossbars; dorsal and anal lobes in adult, reaching beyond middle of C. Dorsal lobes black in young; no axillary spot. Head 3¾; depth 1⅔. D. VI–I, 19. A. II–I, 18. L. 20. W. I., occasionally N. to Cape Cod. (Lat., scythe-shaped.)

bb. Body oblong, the depth about ⅔ the total length.

430. **T. goodei** Jordan & Evermann. Permit. Pampano. Head 3, D. VI–I, 19; A. II–I, 17. D. and A. less falcate than in *falcatus* but reaching beyond middle of fins when depressed. Bluish silvery above, silvery below; D. C. and A. lobes black; no crossbars. L. 3 ft. W. I., N. to N. C.; not common N. (To G. Brown Goode.)

aa. Dorsal with 25 to 27 soft rays; anal with 22 to 26. Dorsal and anal lobes not very high.
d. Depth in adult 2½ in total length.

431. **T. carolinus** (Linnaeus). Common Pampano.[1] Body oblong, moderately compressed; its thickness $\frac{1}{3}$ its depth; snout bluntly rounded; mouth nearly horizontal, maxillary to middle of eye; teeth obsolete in the adult. Lobes of dorsal and anal moderate, reaching where depressed about to middle of fin. Bluish above, silvery below. Head 4; depth $2\frac{1}{2}$. D. VI–I, 25. A. II–I, 23. L. 18. South Atl. and Gulf Coasts, on sandy shores, N. to Cape Cod; the finest foodfish in these waters, the flesh firm, white, and delicate, better than that of any others of our *Carangidae*, comparable to that of the Ulua (*Caranx melampygus* Cuvier & Valenciennes) of the South Seas. (Named for Carolina.)

dd. Depth of body about half length.

432. **T. argenteus** Cuvier & Valenciennes. Silvery Pampano. Dorsal soft rays about 25; anal 22 or 23; body compressed and silvery. W. I. (rare), accidental N. to Woods Hole. (Lat., silvery.)

Family LXXXVIII. SERIOLIDAE (The Amber Fishes)

Similar to the *Carangidae* in technical characters, but the anal fin with much fewer rays, its base shorter than the abdomen. No posterior bony arch behind the body cavity. Large fishes of the warm seas.

a. Dorsal and anal without finlets; body rather robust.
b. Dorsal spines free, their membranes lost with age. . . . . Naucrates, 247.
bb. Dorsal spines connected, their membranes persistent. . . . . Seriola, 248.
aa. Dorsal and anal each with two finlets, body elongate. . . . . Elagatis, 249.

247. NAUCRATES Rafinesque (Gr., ναυκράτης, pilot)

433. **N. ductor** (Linnaeus). Pilot Fish. Romero. Bluish with about 6 broad dark vertical bars. Head 4; depth 4. D. IV–I, 26. A. II–I, 16. Open Atlantic, occasional on our coast. (*Eu.*) (Lat., leader.)

248. SERIOLA Cuvier (Amber Fishes) (An Italian name)

434. **S. zonata** (Mitchill). Rudder Fish. Medregal. Coronado. Bluish, with 6 broad black bars, which disappear with age; an oblique dark band from eye to spinous dorsal; V. mostly black. Head longer than deep; occiput compressed; tail keeled. Head $3\frac{1}{2}$, depth $3\frac{1}{3}$. D. VII–I, 38. A. II–I, 21. L. 30. W. I., not rare, N. to Mass. Bay. (Lat., banded.)

435. S. lalandi Cuvier & Valenciennes. Amber Fish. Amber Jack. Coronado. Body rather more slender than most related species. Bluish green, paler below. A band of pale greenish yellow as wide as eye, from preopercle to caudal fin; mouth rather large, the maxillary to middle of eye, $2\frac{1}{6}$ in head, gill rakers rather slender. Head 4; depth $3\frac{2}{5}$. D. VII–I, 34. A. II, I, 27.

[1] Spanish, *Pámpano*, a grape leaf, from the form; often misspelled *Pompano*.

Dorsal lobes $2\frac{1}{3}$ in head. A valuable foodfish, reaching 5 or 6 feet and 100 pounds. W. I. to Brazil, occasionally N. to N. J. (Named for De Lalande, an early French naturalist.)

436. **S. dumerili** Risso. Amber Jack. Coronado. Depth 3; body little compressed. Grayish, silvery below; a gilt band through eye to C.; no cross-bands in adult. L. 24. Tropical Atlantic, rare N. to Woods Hole. (To A. M. Constant Duméril.)

249. ELAGATIS Bennett (Gr., *ἠλακάτης*, a spindle)

437. **E. bipinnulatus** (Quoy & Gaimard). Light blue, yellow below; side with three conspicuous longitudinal stripes of light blue. Head $3\frac{5}{6}$; depth $3\frac{3}{4}$. D. VI–I, 27–II. A. II–I–17–II. L. 3 feet. Open seas, rarely N. to L. I. (Lat., *bis*, two; *pinnula*, finlet.)

Family LXXXIX. POMATOMIDAE (The Bluefishes)

Closely allied to the *Carangidae* but with the scales larger and weakly ctenoid. Mouth large, oblique, with very strong, sharp, unequal teeth; premaxillaries protractile; caudal peduncle stout, the fin moderately forked, with broad lobes; preopercle serrate; lateral line unarmed. First dorsal of about 8 fragile spines; second D. and A. long; anal spines minute. A single existing species, found in most warm seas, the northern Pacific excepted. Common in the E. Mediterranean.

250. POMATOMUS Lacépède (Gr., *πῶμα*, opercle; *τομός*, cut)

438. **P. saltatrix** (Linnaeus). Bluefish. Skipjack. Bluish, silvery below; a black blotch at base P.; body robust, somewhat compressed; P. inserted low, nearly 2 in head. Head $3\frac{1}{3}$; depth 4. D. VIII–I, 25. A. II–I, 26. Lat. l. 95. L. 3 ft. Warm seas, common on our Atlantic coast; an excellent and gamy fish of fine flavor, but very destructive to other species, especially to the weakfish (*Cynoscion regalis*). (*Temnodon saltator* Cuvier.) (Lat., leaper.)

Family XC. STROMATEIDAE (The Butter Fishes)

This family is allied to the *Carangidae*, differing in the presence of numerous horny, barbed, or hooked teeth in the esophagus, and in the greater number of vertebrae (30 or more). There are no free anal spines, and the spinous D. is very much reduced or even wanting. Ventrals minute or absent; premaxillaries not protractile; caudal peduncle slender, the fin widely forked; opercles entire; gill membranes free from the isthmus (broadly attached in the Asiatic family of *Pampidae*). All are silvery, the head rounded and the sides much compressed. Fishes of the warm seas, well flavored and valued as food.

a. Pelvis ending in a sharp spine; V. wanting.
b. Dorsal and anal little elevated. A series of large, open pores along side of back.
Poronotus, 251.

bb. Dorsal and anal falcate, their lobes high, longer than head. No series of pores along side of back. . . . . PEPRILUS, 252.

251. PORONOTUS Gill (Gr., *πόρος*, pore; *νῶτος*, back)

439. **P. triacanthus** (Peck). DOLLARFISH. BUTTER FISH. Bluish, silvery below; body oval, compressed, the snout very blunt; a row of conspicuous pores along side of back, above lateral line. D. and A. not falcate, their lobes shorter than head. Head 4; depth $2\frac{1}{3}$; D. III, 45. A. III, 37. L. 10. Nova Scotia to Fla., common N.; a good food fish. (Gr., *τρίς*, three; *ἄκανθα*, spine.)

252. PEPRILUS Cuvier (*Rhombus* Cuvier, preoccupied)

440. **P. paru** (Linnaeus). HARVEST FISH. Bluish, yellow below; body almost circular; the snout vertical; no pores along back; dorsal and anal falcate, their lobes longer than head. Head 4; depth $1\frac{1}{2}$. D. III, 45; A. II, 43. L. 8. South Atl. Coast, N. to Cape Cod, scarce. (Brazilian name.)

FAMILY XCI. CENTROLOPHIDAE (THE RUFFS)

Body oblong, covered with moderate cycloid, adherent scales; lateral line present; mouth moderate, with small teeth; tooth-like processes in the esophagus as in the *Stromateidae*. Vertebrae in normal number, 10 + 14 = 24. Dorsal with long base; a few (3 to 10) spines. A. similar, shorter. V. well developed, I, 5. Caudal lunate, the peduncle stout. Species few, at moderate depths, in most Northern Seas.

a. Dorsal spines seven, short and stout, subequal, nearly free; fins low; preopercle finely serrate, sides of head scaly. (*Mupinae.*) . . . . . PALINURICHTHYS, 253.

253. PALINURICHTHYS Bleeker (*Palinurus*, ancient name of some similar fish; from Gr., *πάλιν*, rudder; *ἰχθύς*, fish)

441. **P. perciformis** (Mitchill). BLACK RUDDER FISH. LOGFISH. Body oblong; preopercle serrulate; dorsal spines strong, low, scarcely connected by membranes, snout blunt, eye large. Dusky greenish everywhere. Head $3\frac{1}{3}$, depth $2\frac{1}{2}$. D. VII–I, 20. A. III, 16. Scales 75. L. 12. Nova Scotia to N. J., frequent northward. (Lat., perch-shaped.)

FAMILY XCII. NOMEIDAE (THE MAN-OF-WAR FISHES)

Body oblong, compressed with small smooth scales, head without spines; mouth small, with small teeth; dorsal fin low, divided; pyloric caeca very numerous. Vertebrae numerous (about 40). Small fishes of the open seas, often hiding under the "Portuguese Man-of-war" (*Physalia*), swimming freely among its poisoned tentacles.

a. Ventrals very long and broad, longer than pectorals, depressible in a deep groove of the abdomen. . . . . NOMEUS, 254.

254. NOMEUS Cuvier (Gr., *νόμευς*, pastor, an old name of some fish)

442. **N. gronovii** (Gmelin). Man-of-war Fish. Brownish, silvery below, with large round black blotches, ventrals black. Head $3\frac{2}{5}$; depth $3\frac{1}{5}$. D. X–I, 26. A. III, 26. Open seas, abundant, N. in the Gulf Stream to Cape Cod. (For Lorentz Gronow (Gronovius), one of ablest contemporaries of Linnaeus and Artedi.)

Note. Several species of *Psenes*, distinguished from *Nomeus* by having the ventrals shorter than the pectorals, have been taken on our coast — stragglers from the open sea.

Family XCIII. CORYPHAENIDAE (The Dolphins)

Body elongate, compressed, with small, cycloid scales; mouth wide, with moderate teeth; opercles entire; occipital crest extending well forward, becoming excessively high in the adult ♂, not noticeable in females or young. D. continuous, from nape nearly to C., without distinct spines; A. similar, shorter; V. I, 5; P. short; C. widely forked. Gill openings wide. No pseudobranchiae nor air bladder. Vertebrae more than 24. Species 2 or 3, large, vigorous fishes of the open seas. The bright coloration grows pale at death, but the accounts of this change have been much exaggerated. (These fishes are not to be confounded with the true Dolphin (*Delphinus*), a porpoise-like mammal.)

255. CORYPHAENA (Artedi) Linnaeus (Gr., *κόρυς*, helmet; *φαίνω*, to show)

a. Frontal profile convex in adult; maxillary reaching front of pupil.

443. **C. equisetis** Linnaeus. Small Dolphin. D. 51 to 55; A. 24 to 26. Color brilliant but evanescent; brownish green on back; white or golden below; sides with blue spots; D. blue; C. yellow. Oceanic, very rare on our coast. (Lat., horsetail.)

aa. Frontal profile nearly vertical in adult; maxillary reaching to or beyond middle of eye.

444. **C. hippurus** Linnaeus. Common Dolphin. Dorado. Very bright golden-green, with small round sky-blue spots. Head $4\frac{2}{3}$; depth $4\frac{1}{2}$; V. $1\frac{1}{4}$ in head; P. $1\frac{1}{2}$. D. 59 to 63. A. 29. L. 3 to 5 feet. Open sea, N. to Cape Cod, abundant S. (Gr., *ἵππος*, horse; *οὐρά*, tail.) (*Eu.*)

Family XCIV. RACHYCENTRIDAE

(The Sergeant Fishes)

Body elongate, fusiform, with very small scales; head long, low; mouth moderate; jaws with bands of small teeth; chin projecting; lateral line present,

wavy. Dorsal spines about 9, low, all separate; second D. and A. long; 2 weak anal spines; V. I, 5. C. forked; no air bladder; no sucking disk; pyloric caeca branched. Species few, in all warm seas, nowhere common.

256. RACHYCENTRON Kaup (*Elacate* Cuvier)
(Gr., *ῥαχίς*, axis of body; *κέντρον*, spine)

445. **R. canadum** (Linnaeus). Crab-eater; Sergeant Fish. Cobia. Dusky, sides with a broad black band. Head $4\frac{1}{4}$; depth $5\frac{2}{3}$; D. IX, 33. A. II, 25. Scales very small. L. 5 feet. Warm seas, N. in summer on our Atl. Coast. (Named for Canada by error.)

Suborder **PERCIFORMES** (The Perch-like Fishes)

This great group differs little technically from the *Scombriformes*. In general, the armature is stronger, the scales rougher, and the caudal peduncle stouter, with a less-forked fin.

Family XCV. CENTRARCHIDAE (The Sunfishes)

Body oblong or subcircular, compressed, the regions above and below the axis corresponding. Mouth terminal; teeth small, even; premaxillary protractile; maxillary with a supplemental bone, which is in some genera minute or obsolete; in all species there is at least a trace of this bone, though often concealed in the skin; preopercle entire or nearly so; preorbital deep, not sheathing the maxillary; gill membranes separate, free from isthmus; pseudobranchiae small, concealed. B. 6; lower pharyngeals separate; scales usually large; lateral line present. Dorsal continuous, with 6 to 13 spines; anal spines 3 to 8. Vertebrae about 30. Intestines short, with a few caeca. Sexes similar, but the changes in form due to age often considerable. Species about 25. Carnivorous fishes, especially characteristic of the Mississippi Valley; all but one (*Archoplites interruptus* of Cal.) confined to the waters of the E. N. Am. All of the species build nests, and most of them are voracious and gamy.

a. Dorsal fin much longer than anal fin.
  b. Body comparatively elongate, the depth in adult about $\frac{1}{3}$ the length; no ear flap; dorsal fin low, deeply emarginate with 10 weak spines; anal with three; mouth large; scales rather small. (*Micropterinae.*)
    c. Pyloric caeca mostly branched; dorsal fin almost divided into two; mouth very large, the maxillary in the adult extending beyond eye; caudal vertebrae 17 or 18; soft D. and A. scaleless. . . . . Huro, 257.
    cc. Pyloric caeca mostly simple; dorsal fin less deeply divided; mouth smaller, the maxillary not extending behind eye; caudal vertebrae 16 or 17; soft D. and A. scaled. . . . . Micropterus, 258.
  bb. Body comparatively short and deep, 2 to $2\frac{1}{2}$ in length to base of caudal; dorsal fin not deeply divided. (*Lepominae.*)
    d. Anal spines 3.
      e. Caudal fin lunate; opercle with a black ear flap.
        f. Tongue without teeth; preorbital entire.
          g. Lower pharyngeals narrow, their teeth sharp and not paved.

h. Supplemental maxillary well developed; scales almost cycloid; palatine teeth evident; pectoral fins short, rounded. . . . . APOMOTIS, 259.
hh. Supplemental maxillary rudimentary, concealed in the skin or absent; scales strongly ctenoid.
i. Lateral line complete.
j. Sensory cavities in cranial and facial bones small; opercular bone extending to end of black "ear."
k. Teeth developed on palatines; pectorals rounded, and much shorter than head; gill rakers rather short but strong; pectorals long.
l. Opercle truncate, and stiff to margin, as in *Eupomotis*.
SCLEROTIS, 262.
ll. Opercle produced as a long soft flap, as in *Xenotis*. LEPOMIS, 261.
kk. No palatine teeth; opercle flexible to tip, and more or less produced.
m. Pectorals rounded, and much shorter than head; gill rakers rudimentary. . . . . XENOTIS, 264.
mm. Pectorals pointed, about as long as head; gill rakers relatively long. . . . . HELIOPERCA, 265.
jj. Sensory cavities in cranial and facial bones much enlarged; opercular bone ending as a very flexible flap little beyond middle of ear spot; pectorals moderate. . . . . ALLOTIS, 263.
ii. Lateral line incomplete; opercle stiff to rounded margin; gill rakers long.
LETHOGRAMMUS, 260.
gg. Lower pharyngeals broad, with blunt paved teeth; opercular flap short and broad, its lower posterior edge broadly red; pectoral fin longer than head; lower pharyngeals very broad; gill rakers short and soft. EUPOMOTIS, 266.
ff. Tongue and pterygoids with teeth; preorbital serrate; mouth large.
CHAENOBRYTTUS, 267.
ee. Caudal fin rounded behind; pectoral short; opercle emarginate, without ear flap.
§ Dorsal spines 10, the fin angulated, some of the spines elevated; body with black bars . . . . . MESOGONISTIUS, 270.
§§ Dorsal spines normally 9, the fin gently rounded, black bars weak.
ENNEACANTHUS, 271.
dd. Anal spines 4 to 6.
l. Dorsal spines normally 9; caudal fin rounded; dorsal fin not elevated; anal spines rarely 4. . . . . ENNEACANTHUS, 271.
ll. Dorsal spines 11 or 12.
m. Anal spines 5; caudal rounded. . . . . ACANTHARCHUS, 269.
mm. Anal spines 6; caudal emarginate. . . . . AMBLOPLITES, 268.
aa. Dorsal fin not longer than anal fin; gill rakers long and slender.
n. Dorsal spines 5 to 8; anal spines 6; body oblong, compressed. (*Pomoxinae.*)
POMOXIS, 272.
nn. Dorsal spines 11 or 12; anal 7 or 8; body short and deep. (*Centrarchinae.*)
CENTRARCHUS, 273.

257. HURO Cuvier (For Lake Huron)

446. **H. salmoides** (Lacépède.) LARGE-MOUTHED BLACK BASS. BAYOU BASS. Body rather deeper and more compressed than in the next, growing deeper with age; scales on cheek large, in about 10 rows; 9th D. spine not half length of longest. Mouth very large, the maxillary in the adult extending beyond the eye; scales rather large, about 8–68–16; last spines of D. very short, so that the fin is almost divided into two. Color dark green, silvery below; sides with a broad blackish band in young, with some dark spots above and below it; 3 dark stripes across cheeks; C. pale at base and tip mesially dusky. Adult dull green, nearly plain except for traces of the black lateral band. Head 3¼; depth 3. D. X, 13. A. III, 11. Scales 8–68–16. L. 1 to 2½ feet; weight 3 to 8 pounds — often larger in Florida. Manitoba to N. Y., S. to Fla. and Mexico; everywhere abundant, preferring lakes, bayous, and

sluggish waters. A less active fish than *M. dolomieu*, and less valued as game. (*Huro nigricans* Cuvier.)

258. MICROPTERUS Lacépède (Gr., μικρός, small; πτερόν, fin)

a. Sides with a black band (fading with age); scales 59 to 66; D. soft rays 11 or 12.

447. **M. pseudaplites** Hubbs. KENTUCKY BASS. Body slenderer and more pike-like than other basses in young, but fully as robust in adult. Scales on cheek fewer than in *salmoides*, but larger than in *dolomieu*. Dorsal rather more deeply emarginate than in latter. Color of young nearly as in *Huro*, but horizontal streaks below lateral band more continuous and conspicuous, and caudal marked with orange and black as in *dolomieu*. W. Va., S. Ohio and Ky., to S. E. Kans. and Tex.; especially common in Ky. and Ark.; long confused with other species, but sharply differentiated. (Description by Hubbs.) (Gr., ψευδής, false + *Aplites*, from the strong superficial resemblance to the large-mouth Black Bass, called incorrectly *Aplites*, an error long ago introduced by the present author, belying the real relationships.)

aa. Sides with vertical bars (fading with age); scales 72 to 75; D. soft rays 13 to 15.

448. **M. dolomieu** Lacépède. SMALL-MOUTHED BLACK BASS. Body ovate-oblong, growing deep with age; scales on the cheek small, in about 17 rows; D. less deeply notched than in the preceding; the 9th spine about half as long as the longest. Mouth large, but smaller than in *Huro*, the maxillary in adult not extending beyond eye. Coloration variable, the young dull golden, green, with darker spots on sides which tend to cluster in short vertical bars; never with a black lateral stripe; 3 bronze bands across cheeks; a dusky spot on opercles; C. orange, next black, with a white tip; young with the black on tail conspicuous; D. with bronze spots. Adult nearly uniform olive-green. Head $3\frac{1}{2}$; depth $3\frac{1}{3}$. D. X, 13 to 15. A, III, 10. Scales 10 or 11–72 to 75–17. L. 1 to 2 feet; weight 2 to 7 pounds. St. Lawrence River to Dakota, S. to S. C., Ala., and Tex., in clear and running streams only. A better game fish by far than the Big-mouth. "The Black Bass is eminently an American fish; he has the faculty of asserting himself and of making himself completely at home wherever placed. He is plucky, game, brave, unyielding to the last, when hooked. He has the arrowy rush and vigor of a trout, the untiring strength and bold leap of a salmon, and fighting tactics peculiarly his own. I consider him inch for inch and pound for pound the gamest fish that swims." (*J. A. Henshall.*) (To Dolomieu, a noted French mineralogist.)

259. APOMOTIS[1] Rafinesque (Gr., ἀπώμα, without opercle; οὖς, ear) (*Bryttus* Cuvier & Valenciennes)

449. **A. cyanellus** (Rafinesque). GREEN SUNFISH. Body oblong, the back

[1] Three additional, well-marked, but very rare forms have been described; but are thought to be hybrids not distinct species. These are: *Apomotis phenax* Cope and Jordan, from N. J., *Helloperca tschyra* Jordan & Nelson, from Illinois R., and *Eupomotis eurycrus* McKay, from Lake Huron.

not elevated; mouth large, the maxillary nearly to middle of eye; dorsal spines low, about equal to snout; opercular flap short, with pale margin. Green, with brassy luster, especially below, each scale with a blue spot and gilt edging; fins largely blue, A. edged with orange, iris red; cheeks with blue stripes; a distinct black spot at posterior base of dorsal and of anal. Adult with 7 or 8 bars of dark orange. Head 3; depth $2\frac{1}{2}$. D. X, 11. A. III, 9. Lat. l. 48. L. 7. Great Lakes to Ga. and Mexico; very abundant in small brooks, especially S.; very variable. (Gr., *κυανεός*, dark blue.)

260. LETHOGRAMMUS Hubbs (Gr., *λέθος*, forgetting; *γραμμή*, line)

450. **L. symmetricus** (Forbes). Body short, deep; mouth moderate. Dark green, sides with 10 vertical bars; dorsal in ♀ with black ocellus on last ray; cheek not striped; opercular spot higher than long; spines low, gill rakers long; lateral line incomplete. Head $2\frac{2}{3}$; depth $1\frac{3}{4}$. Scales 6–34–14. L. $2\frac{1}{2}$. Ill. to La., not rare. A small neat species. (Gr., *σύμμετρος*, symmetrical.)

261. LEPOMIS Rafinesque (Gr., *λεπίς*, scale; *πώμα*, opercle) (*Ichthelis* and *Pomotis* Rafinesque)

451. **L. auritus** (Linnaeus). Red-bellied Sunfish. Body oblong; mouth moderate, the maxillary past front of eye; gill rakers quite short, but stiff and rough; scales on cheek in 7 rows. D. spines low. Olive, belly and lower fins largely deep red; scales on sides with bluish spots; bluish stripes on head, especially before eye. Head without flap, 3; depth $2\frac{1}{3}$. Lat. l. 47. L. 8. Me. to Va., only E. of the mountains; generally abundant, usually known at sight by the long, narrow ear flap. (Lat., long-eared.)

452. **L. solis** (Cuvier & Valenciennes). Similar to *L. auritus* but deeper and with larger scales on cheeks and belly, the cheeks with 4 to 6 rows (5 to 6 in "*solis*," 4 in *mystacalis*). A dusky blotch on last rays of dorsal above base; paired fins long; gill rakers slender; opercular flap shorter, and without border. Dusky, sides silvery with irregular short cross-shades; a pale stripe from mouth across opercle; silvery below; lower parts and most of fins yellow. Head $3\frac{2}{5}$; depth 2. Scales 51. Rivers, Va. to La., perhaps more than one species included. (This account is from *L. mystacalis* Cope, Fla.) (Lat., of the sun.)

262. SCLEROTIS Hubbs (Gr., *σκλέρος*, hard; *οὖς*, ear)

453. **S. miniatus** (Jordan). Body regularly elliptical; mouth rather large; ear flap short and broad, entirely dark. Gill rakers short, rather stout; pectorals shorter than head, rounded; pharyngeal teeth bluntish; dorsal spines rather long; male with about 14 rows of orange spots, the lower series very bright; a few black spots on sides and below pectorals; belly orange, spotted

with red. Head $2\frac{3}{4}$; depth $2\frac{1}{4}$. Fla. to S. Ill., common S. A small, brilliantly colored species. (*Lepomis garmani* Forbes.) (Lat., vermilion.)

263. ALLOTIS Hubbs (Gr., ἄλλος, another; οὖς, ear)

454. **A. humilis** (Girard). Body oblong; spines high; cheeks with 5 rows of scales. Olive, with greenish specks posteriorly; sides with round orange spots; belly and lower fins red; sides of head with 4 orange stripes; no black blotch on dorsal. Head $2\frac{3}{4}$; depth $2\frac{1}{4}$. L. $2\frac{1}{2}$. Ohio to N. D. and Texas; very abundant S. W. (Lat., humble.)

264. XENOTIS Jordan (Gr., ξενός, strange; οὖς, ear)

455. **X. megalotis** (Rafinesque). Long-eared Sunfish. Body short and deep, the profile steep; mouth small, the maxillary to middle of eye; pectoral short, rounded; gill rakers very short, weak and flexible; no palatine teeth; opercular flap in adult extremely long, with or without pale margin, variously shorter in young; scales on cheek in 5 rows. Brilliant blue and orange, the former color predominating below, the blue in wavy streaks, the orange in spots; head with conspicuous blue stripes; fins mostly with membranes orange, the rays blue; V. dusky; no black spot on D. or A. Head without flap, 3; depth $1\frac{2}{3}$ to $2\frac{1}{4}$. Scales 5–38–14. L. 6. Mich. to Dakota, S. to Fla. and Mexico; very abundant, especially in the Middle West. A beautiful and strongly marked little fish. (Gr., μεγαλός, long; οὖς, ear.)

Represented in Great Lakes region by subspecies **peltastes** (Cope). A northern form with the ear flap moderate, broadly bordered with red ; size small. (Gr., πέλτη, shield.) Represented in Kans. and S. by subspecies **breviceps** (Baird & Girard). Frontal region in large males very gibbous and ear flap excessively enlarged. (Lat., *brevis*, short; *ceps*, head.)

265. HELIOPERCA Jordan (Gr., ἥλιος, sun; περκή, perch) (Bluegills)

456. **H. incisor** (Cuvier & Valenciennes). Bluegill. Copper-nosed Bream. Dollardee. Body deep, compressed, the young slender, the adult very deep; tail slender; head small; mouth quite small, the maxillary barely to eye; gill rakers slender, rather long, about 10 below angle; D. spines higher than in related species. Ear flap broad, short, all black except slight pale edge above and below. A distinct black spot on base of last dorsal rays; usually none on anal. Olive-green; young purplish silvery, with greenish crossbars; no blue stripes on cheek; no red on fins; old specimens often dusky, with the belly coppery-red. Head 3; depth 2. Scales 44. L. 10. Great Lakes to Kans., Fla., and Mexico; very abundant west of the Alleghenies, where it is the chief member of the family. Very variable, but usually known by the black

dorsal spot, which it shares with *Apomotis cyanellus*. (*Labrus palladus* Mitchill is probably *L. auritus*.) (Lat., one who cuts.)

457. **H. macrochira** (Rafinesque). Similar to *H. incisor*, but with bronze or orange spots forming chain-like bars; orange on fins, no stripes on cheek. P. long, reaching A.; no black spot on D. Scales 44. Ohio Valley; not common. Perhaps not a valid species.

266. EUPOMOTIS Gill & Jordan (Gr., εὖ, true + *Pomotis*, a preoccupied name for the genus)

a. Cheeks without orange or blue streaks or lines; lower pharyngeals not very broad.
b. Scales large, 34 to 39; opercular spot small, edged with blood red.

458. **E. heros** (Baird & Girard). Form of *Helioperca incisor*. Greenish, mottled; pectorals long. S. Ind. to Fla. and Texas, scarce. Known from related species by the larger scales. (*Heros*, a South American genus of *Cichlidae*.)

b. Scales moderate, about 45.

459. **E. holbrookii** (Cuvier & Valenciennes). Eye large, the maxillary reaching its front; cheeks with 5 rows of scales; spines high; P. long, longer than head; opercular spot large. Dusky olive, silvery below; somewhat mottled; belly yellow; fins nearly plain, the lower yellow. Cheeks without blue or orange lines. Head 3; depth 2. Scales 6–45–14. L. 8. Virginia to Florida, in lowland streams. (To John Edwards Holbrook, author of *Ichthyology of South Carolina*.)

aa. Cheeks with orange and blue streaks; opercular spot roundish, very conspicuously bordered below and behind by scarlet.

460. **E. gibbosus** (Linnaeus). Common Sunfish. Pond Bream. Pondfish. Pumpkin Seed. Sunny. Kivver. Body robust, the back elevated, but not much compressed; the front steeper, scarcely forming an angle above eye; the short snout little projecting; eye large, the maxillary reaching its front; cheeks with 4 rows of scales; spines moderate; P. scarcely longer than head; opercular spot moderate, broad, black, broadly edged behind and below with orange. Greenish olive, the sides bluish, the belly and lower fins orange; the sides profusely mottled with orange; D. bluish, orange-spotted. Cheeks orange, with blue wavy streaks. Head $3\frac{1}{4}$; depth 2. D. X, 11. A. III, 10. Scales 6–47–13. L. 8. Minn., and Great Lakes to N. B., and S. to S. C.; exceedingly abundant N. and E., but in Western rivers rarely coming south of the latitude of Chicago. A familiar and lively inhabitant of clear brooks, defending its nests with much spirit. "A very beautiful and compact fish, perfect in all its parts, looking like a brilliant coin fresh from the mint." (*Thoreau*.) (Lat., gibbous.)

267. CHAENOBRYTTUS Gill (Gr., χαίνω, to yawn + *Brytius* = *Apomotis*)

461. C. gulosus (Cuvier & Valenciennes). Warmouth. Red-eyed Bream. Body oblong, robust; eye moderate. Olive-green, sides brassy, with blotches of bluish, greenish, and copper-red; cheeks with 3 or 4 dark bands; fins dusky, mottled; a dark spot on last D. rays; young barred; some specimens with rows of dark spots on sides. Head $2\frac{2}{5}$; depth $2\frac{1}{3}$. D. X, 10; A. III, 9. Scales 6–40–12. L. 10. L. Michigan to Florida and Texas, abundant, especially S. in sluggish waters. (Lat., big-mouthed.)

268. AMBLOPLITES Rafinesque (Gr., ἀμβλύς, blunt; ὁπλίτης, armed)

462. A. rupestris (Rafinesque). Rock Bass. Redeye. Goggle-eye. Body oblong; eye very large. Olive-green, sides brassy, much mottled with dark green; young with blackish bars; adult with rows of dark spots along sides; iris red. Head $2\frac{3}{4}$; depth 2. D. XI, 10. A. VI, 10. Scales 5–40–12. L. 12. Vermont to Manitoba, S. to La. and N. C., common W. A fish valued by boys. (Lat., of the rocks.)

269. ACANTHARCHUS Gill (Gr., ἄκανθα, spine; ἀρχός, anus)

463. A. pomotis (Baird). Mud Sunfish. Form of the Rock Bass. Dark green, with 2 or 3 faint dusky longitudinal stripes; cheeks with dark oblique bands; fins plain. Head $2\frac{2}{3}$; depth 2. D. XI, 10. A. V, 10. Scales 6–43–12. L. 6. Hudson R. to S. C., in sluggish streams, coastwise. (*Pomotis*, a synonym of *Lepomis*.)

270. MESOGONISTIUS Gill (Gr., μέσος, middle; γωνία, angle; ἱστίον, sail — for dorsal fin)

464. M. chaetodon (Baird). Body suborbicular, the mouth very small, the fins high, the scales very large. Straw color, with dark clouds; 6 to 8 irregular, sharply defined black bars across body and fins, the first bar through eye. Head 3; depth $1\frac{3}{4}$. D. X, 10. A. III, 12. Scales 4–28–10. L. 3. N. J. to Ga., in sluggish coastwise streams, locally abundant. One of the handsomest of the sunfishes. (Lat., the butterfly fish.)

271. ENNEACANTHUS Gill (Gr., ἐννέα, nine; ἄκανθα, spine)

465. E. obessus (Girard). Dark olive, more or less strongly barred; a dark bar below eye; ♂ with head, body, and vertical fins with round sky-blue spots; ♀ duller, with lower fins and larger, fainter spots; crossbars narrower and less distinct; lateral line usually complete. Head $2\frac{3}{4}$; depth 2. D. IX, 10. A. III, 9. (Number of spines sometimes variable, whence the nominal genera, *Hemoplites* [D. IX., A. IV] and *Copelandia* [D. X., A. IV].) Scales 3–30–9. L. 5. A beautiful little fish. Mass. to Fla., common coastwise. (Lat., fat.)

272. POMOXIS Rafinesque (Gr., πῶμα, opercle; ὀξύς, sharp)

a. Dorsal spines 7 or 8; A. reticulate, like soft D. (*Hyperistius* Gill.)

466. **P. sparoides** (Lacépède). Strawberry Bass. Calico Bass. Speckled Bass. Black Crappie. Barfish. Body oblong, compressed, the profile comparatively even; fins very high. Silvery-olive, much mottled with clear green; vertical fins with green reticulations around pale spots. Head 3; depth 2. D. VII, 15. A. VI, 17. Lat. l. 41. L. 12. Quebec to Manitoba, S. to La.; commonest N. (*Sparus*, the Porgy + Gr., εἶδος, like.)

aa. Dorsal spines 6; A. fin whitish, nearly plain. (*Pomoxis.*)

467. **P. annularis** Rafinesque. White Crappie. Bachelor. Sacalait. Profile more or less distinctly *S*-shaped, the nape gibbous, the head depressed, the snout projecting; mouth very large. Silvery-olive, mottled with dark green. Head 3; depth 2⅓. D. VI, 18. A. VI, 18. Lat. l. about 40. L. 12. Miss. Valley, in quiet waters, commonest S. A fine game fish. Introduced into the Columbia R. and elsewhere on the Pacific Coast. (Lat., ringed.)

273. CENTRARCHUS Cuvier & Valenciennes (*Eucentrarchus* Gill) (Gr., κέντρον, spine; ἀρχός, anus)

468. **C. macropterus** (Lacépède). Flier. Round Sunfish. Body round-ovate; fins high. Green, with rows of dark-brown spots along sides; fins reticulated; young with a black ocellus on D. behind. Head 3¼; depth 2. Scales 5–44–14. D. XI or XII, 12. A. VII or VIII, 15. L. 6. N. C. to Ill., and S., in lowland streams, a handsome fish. (Gr., μακρός, long; πτερόν, fin.)

Family XCVI. ELASSOMIDAE (The Tiny Perches)

Body oblong, compressed, with large cycloid scales; mouth small; teeth conic, strong, on jaws, a few on vomer; upper jaw very protractile; opercles entire; gill membranes broadly united, free from the isthmus; gill rakers very small, tubercle-like; lower pharyngeals narrow, with sharp teeth. B. 5. No lateral line; pseudobranchiae rudimentary. V. normal (I, 5). Dorsal small with 4 or 5 spines; anal with 3; C. rounded; pectoral short. Vertebrae 24. One genus, with two species. They inhabit sluggish, lowland waters of the E. U. S., and are among the smallest of all fishes, reduced sunfishes remotely related to *Pomoxis.*

274. ELASSOMA Jordan (Gr., ἔλασσωμα, a diminution)

469. **E. zonatum** Jordan. Olive-green, finely speckled; sides with 11 dark bars; a round black spot on side behind shoulder; fins spotted; a bar at base

of C. Eye large; mouth small. Head 3; depth 3½. D. V, 9. A. III, 5. Scales 40–19. L. 1½ to 1. S. Ill. to Ark. and La., in grassy brooks. (Lat., banded.)

470. **E. evergladei** Jordan. Dark brown, with darker spots; vertical bands faint or absent; no round black spot on side. D. III or IV–8 or 9. A. III, 5 to 7. Scales 27 to 30–13. L. to 1½. N. C. to Fla. (Of the Everglades.)

Family XCVII. ETHEOSTOMIDAE (The Darters)

Body more or less elongate, little compressed; scales ctenoid; bones of head smooth or very nearly so; opercular bones nearly or quite entire; supraoccipital crest low; pseudobranchiae and air bladder small or more frequently obsolete; teeth even, all sharp, usually present on vomer and palatines; gills 4, a slit behind 4th. Branchiostegals 6; pyloric caeca 2 or 3; dorsal fin of many spines; anal with 2 spines (rarely one); caudal never forked. Small perch-like fishes, extremely active, inhabiting cold brooks in N. E. America. The group comprises much variety of forms, and has been usually divided into numerous genera, which would seem well defined, if the fishes themselves were not so small. There is no considerable variation in the osteology among the species, except in regard to the numbers of the vertebrae. The group is apparently one of comparatively recent origin, and the differential characters have not become very firmly fixed. On the other hand the extremes of the groups, *Ammocrypta* and *Microperca*, have diverged very far from their perch-like ancestors.

The relations of the Darters to the Perches have been aptly expressed by Dr. Stephen A. Forbes: "Given a supply of certain kinds of food nearly inaccessible to the ordinary fish, it is to be expected that some fishes will become especially fitted for its utilization. Thus *Etheostoma* is to be explained by the hypothesis of the progressive adaptation of the young of certain *Percidae* to a peculiar place of refuge and a peculiarly situated food supply. These are the mountaineers among fishes. Forced from the populous and fertile valleys of the river beds and lake bottoms, they have taken refuge from their enemies in the rocky highlands, where the free waters play in ceaseless torrents, and there they have wrested from stubborn nature a meager living. Although diminished in size in connection with their constant struggle with the elements, they have developed an activity and hardihood, a vigor of life and a glow of high color, almost unknown among the easier livers of the lower lands. Notwithstanding their trivial size, they do not seem to be dwarfed, so much as concentrated, fishes."

Their colors are often very brilliant, the males of some species (in *Nothonotus* and *Oligocephalus*, for example), being among the most brilliant fishes known.

The sexes are usually unlike; the females being generally dull greenish and speckled. They prefer clear running water, where they lie on the bottom concealed under stones, darting, when frightened or hungry, with great velocity for a short distance, by a movement of the large pectorals, then stopping as suddenly. They rarely leave the bottom, and are never seen suspended in the water. A few species prefer a sandy bottom, where they lie buried in the sand, with only the eyes visible. The Darters feed largely on the larvae of *Diptera*. The largest reach a length of 8 inches, but the average is about 2½ inches. The species are all American, the majority occurring within the limits of this volume. None are found west of the Rocky Mountains. Of the many genera, *Percina* and *Hadropterus* are nearest the primitive form, from which others diverge in two or three different directions. It is convenient to begin with some of the more aberrant forms in which scales and fins are especially degenerate.

a. Body extremely elongate, hyaline, subterete, the belly mostly naked; lateral line complete; head long, pointed, gill membranes somewhat united. (*Ammocryptinae.*)
  b. Premaxillaries protractile; dorsal spines 7 to 11.
    c. Anal spine single; A. nearly as large as 2d D; cheeks and opercles scaly. VIGIL, 275.
    cc. Anal spines 2, the fin small; sides of head rough-scaly, body partly naked. IOA, 276.
  bb. Premaxillaries not protractile; dorsal spines 14; anal fin large, with one weak spine. CRYSTALLARIA, 277.
aa. Body more compact, less hyaline, covered with scales. (*Etheostominae.*)
  d. Premaxillaries protractile, separated by a groove from the frontal region; this rarely crossed by a very narrow frenum.
    e. Anal spine single, obscure; dorsal spines 8 to 10; anal smaller than second dorsal.
      f. Lateral line complete or very nearly so. . . . . BOLEOSOMA, 278.
      ff. Lateral line incomplete, ceasing near middle of body. . . . . VAILLANTIA, 279.
    ee. Anal spines 2, well developed, the first usually the longer.
      g. Gill membranes scarcely connected; cheeks and opercles scaly; belly with ordinary scales.
        h. Lateral line incomplete . . . . . DORATION, 280.
        hh. Lateral line complete. . . . . ANEMOCES, 281.
      gg. Gill membrane broadly joined across the isthmus.
        i. Belly behind ventral fins covered over with scales like those of the sides.
          j. Maxillary normal, not adnate to preorbital. . . . . ULOCENTRA, 282.
          jj. Maxillary adnate to preorbital for most of its length and therefore immovable; mouth very small, below the blunt snout; no teeth on vomer. ETHEOSTOMA, 283.
        ii. Belly behind ventral fins more or less scaleless, or with a single series of more or less modified plates, usually caducous.
          k. Mid-ventral plates not enlarged, indistinct; cheeks well scaled; A. of breeding ♂ much enlarged and tuberculated. . . . IMOSTOMA, 284.
          kk. Mid-ventral plates enlarged and conspicuous; cheeks with few or no scales; A. of breeding ♂ not notably enlarged and without trace of nuptial tubercles. . . . . COTTOGASTER, 285.
  dd. Premaxillaries not protractile (the skin of the middle of the upper jaw continuous with that of the forehead); ventral fins well separated at base.
    l. Cranium broadly ∩-shaped between the eyes; snout conic, pig-like, projecting beyond the inferior mouth; ventral line with caducous scales; dorsal spines 13 to 15; scales small; vertebrae 44; air bladder present, rudimentary. PERCINA, 287.
    ll. Cranium narrower, less broadly ∩-shaped between eyes, snout not pig-like, the mouth less inferior.

m. Belly with enlarged, caducous scales or (if fallen) a naked strip; interspace between ventrals, as wide as base of fin.
n. Palatine teeth present; dorsal spines 12 to 15.
o. Preopercle strictly entire; gill membranes but slightly connected (*A. phoxocephalus* excepted); no red nor blue colors. . ALVORDIUS, 288.
oo. Preopercle more or less distinctly serrate, especially in the young; gill membranes broadly united. . . . . SERRARIA, 289.
nn. Palatine teeth obsolete; dorsal spines 11; males with the lower fins tuberculate in spring. . . . . ERICOSMA, 290.
mm. Belly with ordinary scales, not shed at any time; preopercle entire.
p. Lateral line complete (except in *Hypohomus spilotus*).
q. Anal fin large, scarcely smaller than soft dorsal; size relatively large; ventral fins well separated.
r. Gill membranes nearly or quite separate; no black humeral scale. HYPOHOMUS, 291.
rr. Gill membranes broadly united.
s. Scales very small; mouth long and narrow; black humeral scale present. . . . . SWAINIA, 292.
ss. Scales rather large, mouth small and low. . POECILICHTHYS, 293.
qq. Anal fin small, notably smaller than soft dorsal; mouth small, subinferior.
t. Gill membranes broadly united across the isthmus, ventral fins well separated. . . . . NANOSTOMA, 294.
tt. Gill membranes scarcely united; ventral fins close together at base. NOTHONOTUS, 295.
pp. Lateral line more or less incomplete, developed anteriorly only, some at least, of the posterior scales being without tubes; ventral fins inserted close together; cranium narrow.
u. Lateral line without a strong curve anteriorly, not approaching dorsal contour.
v. Gill membranes not connected across the isthmus; D. spines high.
w. Anal spines always 2. . . . . OLIGOCEPHALUS, 296.
vv. Gill membranes broadly connected across the isthmus (except in *Claricola squamiceps*); a black humeral scale
x. Anal spines 2; D. spines low.
y. Mouth moderate, the lower jaw not projecting. CLARICOLA, 297.
yy. Mouth large, the lower jaw projecting; body long and low; dorsal spines low and even, their tips in the male thickened. CATONOTUS, 298.
xx. Anal spine single; mouth large; top and sides of head without scales; snout sharp. . . . . TORRENTARIA, 299.
uu. Lateral line strongly curved upward anteriorly, approaching the dorsal contour; gill membranes not connected; A. spines 2; top of head scaly or scaleless. . . . . HOLOLEPIS, 300.
ppp. Lateral line wholly wanting; scales large; fins small, a black humeral scale; anal spines 2; 8 dorsal spines. . . . . MICROPERCA, 301.

275. VIGIL Jordan (*Pleurolepis* Agassiz, not of Egerton)
(Lat., awake)

471. **V. pellucidus** (Baird). SAND DARTER. Scales of body not very rough, only those along lateral line and on tail well imbricated; nape thinly scaled, becoming usually wholly naked on median line; belly naked; maxillary barely reaching the large eye; P. short. Translucent, finely dotted above; a series of small square olive blotches along back, and another along lateral line, the latter connected by a gilt band; fins pale. Head 4½; depth 7. D. X–10. A. I, 8. Scales 6–75. Vert. 44. L. 2½. S. Ont. to Minn. and

Ark., abounding in clear sandy streams, where it buries itself in the sand by a sudden plunge, and lies with only the eyes uncovered. (Lat., transparent.)

472. **V. vivax** (Hay). This form better scaled than *V. pellucidus*, the region before dorsal being more or less closely covered with scales; scales firmer and rougher; a dusky bar across base of soft dorsal. Miss. to Tex. (Lat., vivacious.)

276. IOA Jordan & Brayton (Gr., *ἰός*, an arrow or dart)

473. **I. vitrea** (Cope). Side of head closely covered with large, rough-ctenoid scales; middle and lower part of side with rough scales; breast and part of belly naked as is front of back; fins low; P. long. Translucent, with small dark spots on back and sides; fins plain. Head 4½; depth 5. D. VII to IX–11 to 13. A. II, 7. Scales 60. L. 2. Md. to N. C., common in Neuse R. (Lat., glassy.)

277. CRYSTALLARIA[1] Jordan & Gilbert (Gr., *κρύσταλλος*, crystal)

474. **C. asprella** (Jordan). Eyes very large; mouth moderate; cheeks and opercles well scaled; nape scaly; throat and belly naked; premaxillaries not protractile; fins large; C. lunate. Hyaline-olive; sides with 10 dark quadrate blotches, small and far apart; body sometimes with 4 or 5 broad dark cross-bands; fins plain; a dusky shade through eye. Head 4⅕; depth 7. D. XIV–13. A. I, 12. Scales 7–93–X. L. 4. S. Ind. (Rising Sun) to Wisc., Ala., and Ark., in clear water, much the largest of the hyaline or "sand" Darters, approaching *Alvordius*. (Diminutive of *Aspro*, the name of a European genus of similar aspect; from *asper*, rough.)

278. BOLEOSOMA De Kay (Johnny Darters) (Gr., *βολίς*, dart; *σῶμα*, body)

475. **B. nigrum** (Rafinesque). Johnny. Johnny Darter. Body slender, fusiform; snout somewhat decurved; mouth small, sub-inferior. Pale olive, back speckled with brown; sides with numerous W-shaped blotches; males in spring black anteriorly, sometimes entirely black. Head 4⅕; depth 5. D. IX–12. A. I, 8. Vert. 15 + 22 = 37. L. 2½. Dakota to Quebec and Mo., very abundant in small brooks. Typical **nigrum** abounds from Colo. to W. Pa., and S. Canada to Okla. It has 45 to 52 scales on lateral line and 10 to 13 soft dorsal rays; cheeks and breast usually scaleless. (Lat., black.)

[1] The genus *Ammocrypta* Jordan (*beani*), of the rivers in the Southern pinewoods, differs from *Vigil* in having the head entirely naked, the body almost equally so. The genus *Ammocrypta* represents the acme of development of the series of darters with elongate translucent bodies, a natural series extending from *Percina* through *Hadropterus*, *Alvordius*, and *Boleosoma* to *Crystallaria*, *Vigil*, *Ioa*, and *Ammocrypta*. Another well-marked series, at first closely related to these, branches off from *Hadropterus* and *Alvordius* through *Ulocentra*, *Ericosma*, and *Poecilichthys* to *Oligocephalus*, *Nothonotus*, *Catonotus*, etc., culminating in *Alvarius*. This section is distinguished as a whole by firmer skeleton with fewer vertebrae, the skull more convex in cross section, the ventrals inserted close together, the anal fin smaller and the dorsal rays fewer. In habits these are much more quiescent, swimming by sudden jerks. The males in this group are more often adorned with bright red or blue.

Represented along Atlantic drainage from Quebec to Md. by subspecies **olmstedi** (Storer); size generally larger; fins larger and more wavily marked, the soft D. with 13 to 15 rays; scales 45 to 50; cheeks scaled (To Mr. Olmsted, discoverer of the form). Farther S., in Va. and N. C., is subspecies **maculaticeps** Cope: smaller than *olmstedi;* fins about as in *nigrum;* soft D. with 12 (10 to 13) rays; scales 43 to 46, or even fewer; eye larger. (Lat., *maculatus*, spotted; *ceps*, head.)

476. **B. mesaeum** (Cope). Rather robust, with large scales. Head long; snout pointed; pectorals longer than ventrals. Olive, with four brown dorsal blotches and zigzags on sides. Pectorals as long as head. Eye small, $4\frac{1}{3}$ in head; mouth rather large. Head $3\frac{1}{3}$; D. IX–13; A. I, 9. Scales 4–40–5. Platte R., at Fort Kearney. A very doubtful species. (Gr., μέσαιος, intermediate.)

477. **B. susanae** (Jordan & Swain). Very slender; head short and small, the snout decurved; head, nape, breast, and middle of belly naked; fins low. Color of *B. nigrum*. Head $4\frac{1}{2}$; depth $6\frac{1}{2}$. D. VIII–10. A. I, 8. L. 2. Cumberland R., abundant in S. Ky. (To Mrs. Susan Bowen Jordan.)

279. VAILLANTIA Jordan (for Léon Vaillant, author of a monograph of these fishes)

478. **V. camura** (Forbes.) Body slender, with long tail; back somewhat elevated; mouth small, inferior, the snout strongly decurved; cheeks, opercles, and breast scaly, nape naked; lateral line ceasing near middle of body; fins small. Olivaceous, the back spotted; about 10 dark spots on sides; a dark opercular spot; head spotted above; D. and C. barred. Head $4\frac{1}{3}$; depth $5\frac{1}{2}$. D. X–10. A. I, 8. Scales 5–56–10. Vert. 38. L. $2\frac{1}{4}$. Ill. to Ala. and Okla., common S. W. (*B. chlorosoma* Hay.) (Lat., *camurus*, snub-nosed.)

280. DORATION Jordan (new genus: type, *Boleosoma stigmaeum* Jordan) (Gr., δοράτιον, a little dart)

a. Lateral line not complete, body fusiform.

479. **D. stigmaeum** (Jordan). Speck. Body slender, like *Boleosoma;* gill membranes narrowly joined; snout rather pointed; cheeks and opercles scaly, lateral line incomplete, ending under middle of second dorsal; mouth small; olivaceous, with W-shaped markings on sides and many specks; frenum of premaxillary easily torn. Head $4\frac{1}{4}$; depth 5; D. X to XIII–12. A. II, 7. Scales 5–50–10. L. $2\frac{1}{2}$. Ky. to Ga. and Ala. Common S. A little fish, like a *Boleosoma*, but with stiff anal spines. (Gr., στίγμα, spot.)

281. ANEMOCES Jordan (new genus: type, *Ulocentra gilberti* Evermann & Thoburn) (Gr., ἀνεμώκης, swift as the wind)

a. Gill membranes narrowly united:
b. Lateral line complete.
c. Cheeks more or less completely scaled.

480. **A. gilberti** Evermann & Thoburn. Slender; mouth small, horizontal; cheeks and opercles scaly; P. as long as head; olivaceous with dark spotting; gill membranes not united; lateral line continuous. Head 4½; depth 6. D. IX–12. A. II, 9. Scales 55. Clinch R., Tenn. (To Charles Henry Gilbert.)

282. ULOCENTRA Jordan (Snub-nosed Darters)

(Gr., *οὐλός*, complete; *κέντρον*, spine)

a. Gill membranes widely united.
b. Cheeks scaly.

481. **U. simotera** (Cope). Body short and deep; head small, the snout very obtuse; cheeks, opercles, and breast scaly. Olivaceous, back and sides each with a series of quadrate, blackish green blotches; belly saffron; upper parts with red spots; 1st D. with red spots and orange-red edge; 2d D. largely red; C. brown, barred; male in spring with head and fins largely dusky. Head 4⅔; depth 4. D. X–11. A. II, 7. Scales 10–52–12. Vert. 38. L. 3. Tennessee and Cumberland basins. A showy little fish, looking like a goby. (Gr., *σιμός*, snub-nosed.)

482. **U. verecunda** (Jordan & Evermann). Body fusiform, the back somewhat elevated; snout very convex; mouth small, inferior; premaxillaries with very slight frenum; cheeks, opercles, and nape scaly; breast naked; fins very low, the dorsals scarcely joined; spinous dorsal longer than soft. Yellowish, much mottled with green; 6 or 7 quadrate spots on side; a dark bar before eyes; fins speckled, dorsal marked with orange. Head 4½; depth 4½; D. XI–11. A. II, 7. Scales 6–47–9. L. 2. Holston R., Va.; rare. (Lat., modest.)

bb. Cheeks naked or nearly so.

483. **U. histrio** (Jordan & Gilbert). Spinous dorsal shorter than soft; snout very obtuse; dorsals well separated; pectoral a little longer than head; green, with dark crossbars alternating with crossbars of darker green. Head 4. Depth 5. Eye 3 in head; D. X–13. A. II, 7. Scales 6–52–11. South Ind. to Ark. locally abundant. (Lat., harlequin.)

484. **U. blennius** (Gilbert & Swain). Robust, the head deep, its upper profile horizontal, sharply decurved on snout; mouth very small, subinferior; frenum of premaxillary very narrow; gill membranes broadly joined; eye small; fins low, pectoral very long, reaching beyond V.; head and breast scaleless; nape with large scales. Light olive, with 4 conspicuous dark bars above, and numerous dark spots and marblings; each scale on back with a red spot; belly silvery; dorsal with dark-red spots. Tenn. R., N. Ala., not common. (*Blennius*, a genus of fishes.)

485. **U. meadiae** Jordan & Evermann. Body rather heavy; head large, the snout rather blunt, decurved; mouth rather large; maxillary to front of

eye; gill membranes separate; cheeks and breast naked; opercles scaled above; lateral line complete; gill membranes not connected; belly with ordinary scales. Olivaceous, back with 6 dark saddles; sides speckled, with 6 or 8 large blotches along lateral line, sometimes continuous with dorsal blotches; spinous dorsal with a dark band; head with dark markings; upper fins speckled. Head $3\frac{3}{4}$; depth $4\frac{3}{4}$. D. XII–12. A. II, 7. Scales 7–48–8. Powell R. near Cumberland Gap, Tenn. (To Mrs. Meadie Evermann.)

486. **U. longimane** (Jordan). Body moderately slender; head long, bluntish anteriorly, profile of snout steep and nearly straight; mouth moderate, included; maxillary to front of eye; cheeks nearly or quite naked; opercles somewhat scaly, nape naked; lateral line complete; pectoral fins unusually long; dorsals very high; A. spines small. Olivaceous, with 5 dark cross-shades; a dark spot at base of C., fins nearly plain. Head 4; depth 5. D. IX or X–12 or 13. A. II, 8. Scales 6–43–7. L. $2\frac{1}{2}$. James R., Va. (Lat., *longus*, long; *manus*, hand.)

487. **U. podostemone** (Jordan & Jenkins). Body rather stout, the snout bluntly rounded, overhanging the small mouth; gill membranes broadly connected; cheeks, neck, and breast naked; pectorals longer than head, reaching vent; color yellowish green, much mottled and spotted. Head $4\frac{2}{5}$; depth $5\frac{2}{3}$; D. X–12. A. II, 8. Scales 4–35–8. L. 2. Roanoke River, abundant in riverweed (*Podostemon*).

283. ETHEOSTOMA Rafinesque (*Diplesion* Rafinesque) (Gr., ἕτερος, various; στόμα, mouth) [1]

488. **E. blennioides** Rafinesque. Green-sided Darter. Body moderately elongate, little compressed, the head thick, its profile very convex; maxillary adnate to the preorbital for most of its length, and therefore nearly immovable; mouth very small, inferior; no teeth on vomer; eyes large, high up, close together; cheeks, opercles and neck scaly; breast naked; spines strong. Bright olive-green, mottled above; sides with 8 double transverse bars, each pair forming a deep-green, Y-shaped figure; sides with orange dots; fins blue-green, marked with orange-red; ♀ duller. Head $4\frac{1}{2}$; depth $4\frac{3}{4}$. D. XIII–13. A. II, 8. Lat. l. 65 to 78. Vert. 42. L. 5. Mich. to Ala. and Kans., common. One of the prettiest of the darters. (*Hyostoma cymatogrammum* Cope.) (*Blennius* + Gr., εἶδος, like.)

284. IMOSTOMA Jordan (Gr., εἶμι, to move; στόμα, mouth)

489. **I. shumardi** (Girard). Body robust; head broad and thick; mouth large, scarcely inferior; cheeks, opercles, and nape scaly; breast naked; fins all large. Dark olive, blotched with darker; sides with 8 to 10 vague bars;

[1] According to Rafinesque the name means "various mouths," the three species, *blennioides*, *caprodes*, and *flabellare* differing widely in this respect. Rafinesque, with Swainson and others, took large liberties with the flexible language of Greece.

a small black spot on front of spinous D.; a large one behind; fins barred; sub-orbital bar large, black. Head $3\frac{3}{5}$; depth 5. D. X–13 to 15. A. II, 11. Scales 6–56–11. Manitoba and Ohio to Ark., in larger streams. (*Hadropterus güntheri* Eigenmann & Eigenmann.) (To Dr. Geo. C. Shumard.)

285. COTTOGASTER Putnam (Gr., κόττος, a shield; γαστήρ, belly)

490. **C. uranidea** (Jordan & Gilbert). Cheeks and opercles closely scaled; breast nearly naked; nape completely scaly; belly with caducous scales. Olive, dusky above, with black specks which become larger anteriorly; 4 dark crossbars on sides, above lateral line; about 11 dusky spots below, a black bar below eye; fins speckled; no red, blue, or green. Lower Wabash R. to Ark., and S. to Escambia R., Fla.; in sandy streams. A handsomely marked fish. (*Uranidea*, stargazer, an obsolete name for small sculpins.)

491. **C. copelandi** (Jordan). Body slender; head large, narrowed in front; mouth small, subinferior, the snout decurved; gill membranes scarcely connected; anal usually not smaller than second D. Belly with enlarged scales on middle line; these falling off, leaving a naked strip; cheeks and breast naked; opercles and nape with few scales. Pale olive, speckled above, a series of horizontally oblong black blotches along lateral line; fins somewhat barred, dusky in ♂; a black spot on front of first D. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$. D. XI–10. A. II, 9. Scales 46 to 51. Vert. 38. L. $2\frac{1}{2}$. Ohio to Ill. and Kans. (To Herbert Edson Copeland, discoverer of the species, an enthusiastic student of the "Johnny Darters.")

Represented N. E. by subspecies **C. c. putnami** Jordan & Gilbert. Head heavy; mouth moderate, the lower jaw included; maxillary to front of pupil; cheeks, opercles, nape, and breast naked; fin large; caudal lunate; premaxillaries protractile, with sometimes a narrow frenum; gill membranes separate. Brownish, much speckled; about 7 roundish black blotches along sides; spinous dorsal with a medium dark band and a black edge, fins otherwise nearly plain, a dark bar below eye. Head 4; depth 6; eye 4 in head, as long as snout. D. XI–12; A. II, 8. Scales 7–56–8. L. $2\frac{1}{4}$. Lake Champlain to Lake Huron. This description is based on the account of *C. cheneyi* (Evermann & Kendall), a similar species probably identical with *C. putnami*, from Racket R., a tributary of the St. Lawrence, Norfolk, N. Y. (To Frederick Ward Putnam.)

286. PERCINA Haldeman (Log Perches)

493. **P. caprodes** (Rafinesque). Log Perch. Hog Molly. Body elongate; fins rather low; cheeks and opercles well scaled; premaxillaries not protractile (the skin of the middle of the upper jaw continuous with that of the forehead); cranium broad between the eyes; snout conic, pig-like, projecting

beyond the inferior mouth; ventral line with a series of larger scales which fall off, leaving a naked strip; gill membranes separate; scales small. Vertebrae 44. Nape scaly in typical form. Yellowish green, with about 15 dark cross-bands, these usually alternating with shorter and fainter bands; no orange shades; a black spot at base of C.; fins barred. Head 4; depth 6; D. XV–15. A. II, 9. Scales 92. L. 6 to 8. Great Lakes to Va., Ala., and Texas; abundant. The largest of the darters and the one most nearly allied to the perch and similar fishes. Subsp. **zebra** Agassiz, the Manitou Darter, occurs in and about the Great Lakes, and N. W. It has the nape naked; the black bars on sides shorter and confluent. (Gr., *κάπρος*, wild boar; *εἶδος*, like.)

494. **P. rex** Jordan & Evermann. More robust; the fins higher; the sides not barred, but with inky black cross-shades; dorsal fin washed with orange. Head 4, depth 4⅔. D. XIV–15. A. II, 11. Scales 11–84–19. Roanoke R., Va., rare. One of the largest of the darters, a stately and handsome little fish. (Lat., *rex*, king.)

288. ALVORDIUS Girard (To General Benjamin Alvord)

a. Head moderate, the snout not produced and long-acuminate, the mouth moderate.

495. **A. maculatus** Girard. Black-sided Darter. Body fusiform, rather elongate; maxillary reaching just past front of eye; cheeks[1] with small scales; opercles with larger ones; breast naked; nape scaly or not. Greenish yellow, with dark tessellations and marblings above and about 7 large, well-defined, dark blotches along the side, more or less confluent; fins barred; a small spot at base C. Head 4; depth 6. D. XIII to XV, 12. A. II, 9. Scales 9–65–17. Vert. 42. L. 3 to 4. W. Pa. to Dakota and Ark., abundant. Perhaps the most elegant of the darters. (*A. aspro* Cope & Jordan.) (Lat., spotted.)

496. **A. peltatus** (Stauffer). Body rather stout; mouth moderate, maxillary reaching eye; ventral shields large. Olive, the back with short cross-bars; sides with broad brownish shades; a dark blotch on neck and opercle; snout and space below eye with usual bars; fins barred; 1st D. with a black band. Head 4; depth 5. D. XII, 12. A. II, 8. Scales 7–53–9. L. 4. Pa. to S. C., E. of the mountains. (Lat., having shields.)

497. **A. ouachitae** (Jordan & Gilbert). Head and body slender, the snout not blunt, fins moderate, opercles and nape scaly; cheeks, nearly so. Olivaceous, tessellated with dark brown, 6 faint dark bars from back downward and forward; middle of sides with confluent dark blotches much as in *A. maculatus;* no red or blue. Head 4; depth 6½. D. XII–13. A. II, 10. Scales 6–55–10. L. 2. Southern Ind. (New Harmony) to Ky. and Ark.; the types from the Ouachita R., Ark.

[1] In the original type of *Alvordius maculatus*, from Fort Gratiot, Mich., the head is said to be scaleless, but no example with naked head has been found by Hubbs about L. Huron.

498. **A. roanoka** (Jordan & Jenkins). Body robust, head large, blunt; mouth small; P. as long as head, reaching vent; cheeks, opercles, nape, and breast mostly or entirely scaleless. Head 4; depth 4½; eye 4½. D. X–11. A. II, 8 or 9. Scales 5–48–9. Dark green, the female yellow; sides with 12 vertical crossbars of blue-green in males, in females confluent into a jagged cross-shade; ♂ with the head dark blue, nape with a pale spot, a black bar below eye; fins mostly blue-black, dorsal with median band of very bright yellow, yellow washes on other fins; 2 yellow spots on base of caudal; female paler, the bars on fins and caudal more sharply defined. Roanoke River, locally abundant. An elegant inhabitant of mountain brooks.

aa. Head long, the snout produced, long-acuminate.
d. Cheeks and opercles scaly.

499. **A. phoxocephalus** (Nelson). Body slender; mouth large; jaws subequal; maxillary reaching eye; nape scaly; breast naked. Yellowish brown, the lateral spots smaller than in *A. maculatus* and more numerous, quadrate in form; a small dark spot at each end of lateral line. Head 4; depth 5½. D. XII–13. A. II, 9. Scales 12–68–14. Vert. 39. L. 4. W. Pa. and Tenn. to Kans. and Ark., common S. W. (Gr., *φοξός*, tapering; *κεφαλή*, head.)

dd. Cheeks and opercles naked.

500. **A. macrocephalus** (Cope). Body slender, head eel-like, maxillary long jaws subequal; back with dark quadrate spots; sides with 9 blackish, oblong spots, alternating with smaller ones; fins mottled; 1st D. with median dark band. Head 3½; depth 7. D. XV–13. A. II, 11. Scales 11–77–15. L. 3 Ohio Valley, Pa., to Tenn. (Gr., *μακρός*, long; *κεφαλή*, head.)

289. SERRARIA Gilbert (Lat., *serra*, saw)

501. **S. sciera** (Swain). Body rather stout; head short, bluntish; mouth small, the lower jaw shorter; preopercle serrulate; maxillary not reaching eye; cheeks and opercles scaly; breast partly scaled; scales of median line of belly slightly enlarged, probably deciduous; fins very large. Yellowish olive, everywhere vaguely blotched with black, especially along sides; ♂ with head and most fins blackish; ♀ paler. Head 4; depth 5. D. XIII–14. A. II, 9, Scales 7–65–11. Vert. 40. L. 4. Ind. to Ark. and Texas. S. W. occurs subsp. **serrula** Jordan & Gilbert, with preopercle more sharply serrate; markings more definite; scales smaller, about 70; breast naked. Resembles *A. maculatus*. (Gr., *σκιερός*, shaded.)

290. ERICOSMA Jordan (Gr., *ἔρ*, spring time; *κορμέω*, to adorn)

502. **E. evides** (Jordan & Copeland). Body rather stout, compressed; head heavy, rather blunt forward; eye large; mouth smallish, the maxillary reaching eye; lower jaw included; cheeks, nape, and breast naked; opercle

with large scales, no palatine teeth; male with lower fins tuberculate in spring; ventral scales moderate, caducous; fins large. Dark olive, tessellated above; back with 7 broad transverse bars which extend below lateral line; in ♂ deep blue-green, the interspaces yellow with copper-red blotches; throat, cheeks, upper fins, and two spots at base of C. largely orange; A. and V. chiefly blue-black; fins not barred; a black spot on last D. spines; ♀ with paler colors, the bars black. Head 4⅓; depth 5⅓. D. XI–11. A. II, 8. Scales 9–65–9. Vert 40. L. 3. Ind. and Tenn. to Iowa and Ark. One of the most brilliant of the darters. (Gr., εὐειδής, comely.)

291. HYPOHOMUS Cope (Gr., ὑπό, below; ὁμός, uniform)

a. Lateral line complete.
b. Scales very small, about 85.

503. **H. aurantiacus** (Cope). Elongate; snout longer than eye; lower jaw included; cheeks and opercles scaly; throat smooth. Golden-brown, a series of small round brown spots traversed by a black lateral band which extends around snout; yellow below; fins plain. Head 4¼; depth 6. D. XV–15. A. II, 11. Scales 85. L. 4½. Upper Tennessee R. (Lat., orange.)

bb. Scales moderate 60 to 75.

504. **H. cymatotaenia** (Gilbert & Meek). Body robust; head short, the snout short and slender; mouth small, oblique, included; maxillary nearly to front of eye; eye large, 4 in head; cheeks, opercles, nape, and breast with large scales; preopercle entire; gill membranes narrowly joined, the degree of union variable, usually very slight; 1st A. spine long and strong; P. short. Greenish, with fine dark points; 2 pale streaks along sides, below a broad, dusky, wavy band; a small black spot at base C.; fins translucent, with dark lines. Head 4⅛; depth 5. D. XII to XIV–13. A. II, 10. Scales 7–64 to 70–12. L. 4. Ozark region, S. Mo. (Gr., κύμα, wave; ταινία, ribbon or stripe.)

505. **H. nianguae** (Gilbert & Meek). Body elongate, terete; head very long and slender, the snout deep and narrow, vertically rounded at tip; mouth large, maxillary beyond front of orbit; eye shorter than snout, 5½ in head; cheeks with a few rudimentary scales; opercles and breast naked; nape scaled; A. rather smaller than 2d D. Olivaceous, the back with 8 to 10 wide, dusky crossbars, which extend on sides; ♂ with the dark bars encircling body; back and sides with carmine-red spots in the pale interspaces, most numerous in ♂; 2 black spots at base C.; 1st D. dusky, spotted with red, and with red edge; other fins mostly mottled with red. Head 3⅘; depth 6. D. XI or XII–13 or 14. A. II, 11 or 12. Scales 11–74–16. L. 3¾. Niangua R., Ozark region, Mo.

aa. Lateral line not complete; scales about 60.

506. **H. spilotus** (Gilbert). Much like *H. nianguae*, the scales much larger, 58 to 60; lateral line always incomplete. Dorsal edged with red; base of D. with 2 black spots. Head 3½; depth 6; D. XII–13, A. II, 10. Scales 58. L. 2¼. Kentucky River. (Gr., σπιλοτός, spotted.)

292. SWAINIA Jordan & Evermann (To Dr. Joseph Swain, President of Indiana University, later of Swarthmore College)

507. **S. squamata** (Gilbert & Swain). Body elongate, the head long and slender, the snout long-acuminate; mouth long and narrow, the lower jaw included; maxillary to front of eye; eye moderate; gill membranes more or less broadly united. Scales very small, preopercle entire. 1st D. low; A. high, its spines strong; cheeks, breast, nape, and opercle scaly; an enlarged black humeral scale. Yellow-olive, with 10 broad dusky bars on back, and 10 dark blotches along sides; a small black spot at base C.; 1st D. pale, with broad, orange band; 2d D. and C. barred with dusky and orange. Head 3⅖; depth 5½. D. XIV–13. A. II, 10. Scales 10–82–18. L. 4. Tennessee R. system, in N. C. and Tenn. (Lat., scaly.)

293. POECILICHTHYS Agassiz (Gr., ποικιλός, variegated; ἰχθύς, fish)

508. **P. variatus** (Kirtland). Body rather robust, the head short and thick, with short blunt snout, the anterior profile convex; eyes large, 3¾ in head; maxillary to front of eye, 4 in head; mouth small, low; top of head rugose; head almost naked; nape and breast scaled; fins all very large; A. large, rather smaller than soft D.; P. reaching A. Dusky greenish, finely punctate; ♂ with belly and sides orange-yellow; posterior part of body with 5 orange bars; 1st D. with dark-blue band; 2d D., A. and P. blue-black, shaded with orange; ♀ paler. Head 3⅘; depth 4⅘. D. XIII–13. A. II, 9. Scales 8–51–9. L. 4. Ohio Valley to Ark.; scarce. (Lat., variegated.)

294. NANOSTOMA Putnam (Gr., νανός, small; στόμα, mouth)
(*Rhothoeca* Jordan, there being an earlier genus *Nannostomus*)

509. **N. swannanoa** (Jordan & Evermann). Form of *Ulocentra simotera*, the head short and blunt in profile; cheeks, opercles, and breast naked; premaxillaries not protractile; gill membranes broadly joined; fins low; pectorals ⅓ longer than head. Ventral fins well separated. Color dusky green, mottled with blackish and saffron yellow; 8 or 10 black quadrate blotches on side; a small spot below eye; fins speckled. Head 4⅓; depth 6; eye 4 in head. D. XI or XII–13. A. II, 9. Scales 6–48 to 57–7. L. 3. Upper tributaries of Holston and French Broad rivers, first known from Swannanoa R., N. C.

510. **N. thalassinum** (Jordan & Brayton). Similar to *swannanoa*, but scales larger (40 to 48) and pectoral fin only as long as head; D. IX to XI–10 to 12. Santee basin in N. C. and S. C. (Lat., sea green.)

511. **N. zonale** (Cope). Body slender; head small and short, the snout obtusely decurved; cheeks and opercles scaly; breast scaly, or naked (subsp. **arcansanum** Jordan & Gilbert); teeth feeble; dorsals separate; no humeral scale. Olivaceous; ♂ with 6 brown quadrate spots on back, connected by alternating spots with a broad, brown, lateral stripe, from which 8 narrower dark-bluish bars nearly encircle the belly; P., A., and C. golden, speckled with brown; middle half of 1st D. crimson; base of 2d D. with round red spots, a black spot on opercle and one at base P.; ♀ duller, with V. barred. Head 4¼; depth 5. D. XI–12. A. II, 7. Scales 6–43 to 50–12. Vert. 39. L. 2½. W. Pa. and Wisc. to Kans. and Miss., in clear streams. Variable. (Lat., belted.)

295. NOTHONOTUS Agassiz (Blue-breasted Darters)

(Gr., *νοθός*, spurious; *νῶτος*, back; the application obscure)

a. Head short, the muzzle abruptly decurved; scales 7–53–8; 2d D., A. and C. black edged.

512. **N. camurus** (Cope). Blue-breasted Darter. Body stout; mouth somewhat inferior; C. truncate; gill membranes scarcely united; ventral fins close together, opercles and cheeks naked; no black humeral scale; ♂ blackish olive, breast and throat deep, rich blue; sides profusely sprinkled with crimson dots; faint dark lines along rows of scales; 1st D. with black spot in front, above and behind it a crimson one. 2d D., A., and C. crimson, bordered with yellow and edged by blue-black; P. and V. crimson-edged; ♀ greenish, faintly barred. Head 4; depth 4½. D. XI–13. A. II, 8. Scales, 7–53–8. L. 2½. Ind. to Tenn., in clear streams. Perhaps the most beautifully colored of all our fresh-water fishes. (Lat., blunt-headed.)

aa. Head rather long and pointed, the snout not decurved; cheeks naked, opercles scaly.
b. Dorsal spines 10 to 12.
c. Scales 9–58–10; vertical fins without black border.

513. **N. maculatus** (Kirtland). Body moderately elongate, with very deep tail; eye large, maxillary to front of eye; fins short; 1st A. spine large. ♂ olive-black, with a wavy leather-colored dorsal band; throat blue; back and sides with crimson spots; 1st D. with a black spot at base in front; 2d D. blood-red; C. with two confluent crimson spots at base; P. and V. without red border; ♀ dull, the fins speckled and without red. Head 4; depth 5¼. D. XII–12. A. II, 9. Scales 9–58–10. Vert. 39. L. 2½. W. Pa. to E. Tenn., scarce. (*Poecilichthys sanguifluus* Cope.) (Lat., spotted.)

cc. Scales 6–45–7: A. and C. narrowly black-edged.

514. **N. rufilineatus** (Cope). Stout, the back elevated; snout short, as long as the small eye; tail deep. ♂ olive, with numerous narrow longitudinal streaks including irregular quadrate spots of brick red; breast blue; belly orange; head with 2 brown bands, and 5 red spots on each side; fins all broadly bordered with crimson; two orange spots at base C.; A. scarlet-yellow at base,

edge black; ♀ olivaceous, barred; fins speckled. Head 4; depth 4¼. D. XI–12. A. II, 8. Scales 6–45–7. L. 3. Tennessee and Cumberland basins. (Lat., red-lined.)

bb. Dorsal spines 14; scales 8–53–9.

515. **N. vulneratus** (Cope). Much like *N. camurus*, but with more spines, the head less blunt. Body stout, fusiform; tail deep; form of *N. maculatus*. ♂ light olive with 8 dark bars, interrupted above, and a few crimson spots; fins mostly plain; 1st D. with a series of red spots; C. orange, with narrow black edge, as has also 2d D. Head 4; depth 4½. D. XIV–13. A. II, 8. L. 2. French Broad R., Tenn. (Lat., wounded.)

516. **N. cinereus** (Storer). Body slender, the head pointed; mouth moderate, low. Opercles scaled; cheeks, nape, and breast nearly or quite naked; fins moderate; pectorals reaching tips of ventrals. Light yellow, back with 4 dark crossbars, each scale above with a brown spot; along lateral line, 12 oblong dark spots, forming a stripe across head to snout; dorsal fins with red spots, the spinous dorsal with red margin. Head 3½; depth 5½. Eye 4. D. XII–12. A. 11, 8. Scales 58. L. 4. Cumberland and Tennessee rivers, rare. A large and showy species. (Lat., *cinereus*, ashen.)

296. OLIGOCEPHALUS Girard (Rainbow Darters) (Gr., ὀλίγος, few or small; κεφαλή, head)

a. Black humeral spot more or less indefinite or wanting.
b. Lateral line straight, not at all bowed upward anteriorly. (*Oligocephalus.*)
c. Scales large, less than 50 in a series along the side.
d. Cheeks naked.

517. **O. coeruleus** (Storer). Rainbow Darter. Soldier Fish. Body rather stout; less graceful than most species, but very brilliantly colored; head large; mouth moderate, lower jaw the shorter, the maxillary to front of orbit; neck and breast usually naked. ♂ olivaceous, blotched above with darker; sides with about 12 oblique bars of indigo blue running downwards and backwards, the interspaces bright orange; cheeks blue; breast orange; fins chiefly orange and deep blue; ♀ duller, with no blue nor red, the vertical fins barred. No humeral scale; lateral line always incomplete; gill membranes separate; cheeks naked, opercles scaly. Head 3¾; depth 4¼. D. X–12. A. II, 7. Scales 5–45–8; pores 33. Vert. 15 + 21 = 36. L. 2½. W. Pa. to Iowa and Ala., extremely abundant. One of the gaudiest of fishes. Subsp. **spectabilis** (Agassiz), Mo. to Kans., has distinct dark streaks along the rows of scales on back. (Lat., blue.) Subsp. **lepidus** (Baird & Girard), Colo. and Kans. to Mexico, has the opercles as well as the cheeks scaleless.

dd. Cheeks mostly scaly; opercles scaly.

518. **O. jessiae** (Jordan & Brayton). Body fusiform, rather stout, compressed, with rather deep caudal peduncle; head moderately pointed; mouth

terminal, the lower jaw included, caudal truncate; cheeks scaly or partly naked; opercles scaly. ♂ brownish, with crossbars or blotches of greenish; much paler than in *O. exilis;* sides with dark-blue quadrate crossbars; fins speckled with golden. Head 4; depth 5. D. XII–12. A. II, 9. Scales 6–47–7, with tubes on 35 scales. Mich. to Ga. and E. Texas. (To Mrs. Jessie Dewey Brayton.)

cc. Scales smaller, generally more than 50 in lateral line.

519. **O. luteovinctus** (Gilbert & Swain). Compressed, the back elevated, the tail very slender; head compressed, with short, high snout, its profile strongly decurved; mouth low, horizontal; gill membranes narrowly connected; dorsals low, well separated; cheeks and opercles scaly. ♂ very pale olive, with 7 dark crossbars on back; sides with 9 dark greenish blotches, between which are orange-yellow crossbars; small black spots at base of C.; spinous D. with a median orange band, and a dark blotch behind; 2d D. and C. barred. Head $3\frac{3}{4}$; depth $4\frac{3}{4}$. D. IX or X–13. A. II, 7. Scales 6–49 to 55–11. L. 2. Stone R., Nashville, Tenn. (Lat., *luteus*, yellow; *vinctus*, banded.)

bb. Lateral line short, but running high anteriorly, somewhat bowed; body fusiform; fins rather small; gill membranes separate; cheeks scaly.

520. **O. exilis** (Girard). Iowa Darter. Slender, compressed, the caudal peduncle contracted; maxillary to front of pupil; lateral line running high; pectorals extending beyond ventrals; said to have cheeks naked; no humeral scale. Yellowish brown, speckled with dusky; dorsals and caudal barred; a dark spot on occiput; a dark streak before and one below eye. Head $3\frac{3}{4}$; depth 6. D. IX or X–10. A. II, 7 to 9. L. 2 inches. Scales 53, pores 22. Upper Missouri R. and Red R. of the North to Montreal, S. to Iowa and Ohio. (*Poecilichthys iowae* Jordan & Meek. This form has cheeks, opercles, and nape freely scaled.) (Lat., slender.)

aa. Black humeral scales present; cheeks scaled.

521. **O. borealis** (Jordan). Body moderately long, with heavy head, snout short, the lower jaw included. Black humeral spot present; cheeks, opercles, and nape scaly; breast naked. Gill membranes nearly separate; fins all small, a black humeral scale. Dark gray, mottled, sides with about 12 very distinct dark crossbars (perhaps blue in life) each meeting its fellow across the back, a dark saddle between dorsals; caudal with dark bars; spinous dorsal with a dark median band. Head $3\frac{3}{5}$; depth $5\frac{2}{5}$. D. VIII–9. A. II, 7. Scales 4–53–10. L. $2\frac{1}{2}$. Montreal and westward in Canada, rare. Regarded by Hubbs as a synonym of *O. exilis*, but a black humeral scale is present in the type.

aaa. A definite black humeral scale; cheeks scaleless.

522. **O. tippecanoe** (Jordan & Evermann). Resembles *O. jessiae*, but with a conspicuous dark humeral scale; cheeks and breast naked; opercles scaly; nape with fine scales. Mouth large, the maxillary nearly to middle of eye. ♂ dark, the scales much punctulate; sides with 12 dark (blue) vertical bars; red spots at base of C., 3 dark streaks radiating from eye; fins mottled. Head $4\frac{1}{4}$; depth $4\frac{3}{4}$. D. XII–12. A. II, 7. Scales 5–50–8. L. $1\frac{1}{2}$. Tippecanoe R., Ind., and Scioto R., Ohio.

523. **O. punctulatus** (Agassiz). Slender; snout sharp; mouth terminal, the maxillary to middle of eye; cheeks and opercles naked or nearly so; nape with fine scales. Dark slaty-green, with vague irregular darker bars; gill membranes separate; humeral scale distinct; belly and throat orange; body and fins much punctulate and with much dark marbling. Head $3\frac{1}{3}$; depth $5\frac{3}{4}$. D. X–14; A. II, 8. Scales about 70 (63 to 80). L. 2. Ozark region, in small brooks, scarce. Known by its very small scales. (Lat., finely spotted.)

524. **O. cragini** (Gilbert). Body deep; snout short and broad; mouth terminal; black humeral scale conspicuous; fins all small; cheeks, opercles, and breast naked or nearly so; nape scaly. Olivaceous, much speckled; sides with about 12 dusky spots, as large as pupil; caudal strongly barred, sides with blue specks and red shades. Head $3\frac{1}{3}$; depth $4\frac{1}{4}$; D. VIII–11. A. II, 6. Scales about 50. L. $1\frac{1}{2}$. Arkansas R. system in Kans. and Colo., the only darter reaching the Rocky Mountains. (For Professor F. W. Cragin.)

525. **O. obeyensis** (Kirsch). Body long and low; jaws equal; gill membranes scarcely connected; black humeral scale large; cheeks, nape, and breast naked; opercle mostly so. Color brownish, blotched and dotted; back with 6 dark blotches; lateral line with 10 dark shades; a dark spot on cheeks; caudal with 6 or 7 bars. Head $3\frac{2}{3}$; depth 5. D. VI to VIII–12. A. II, 7. Scales 6–44–6. Cumberland R., Ky., and Obey R. (Tenn.) to S. Ill., rare.

526. **O. pagei** (Meek). Body robust, with decurved snout. Mouth large, terminal; cheeks, opercles, and breast naked; nape scaled; humeral scale distinct; scales each with a black spot; fins mottled. Head $3\frac{1}{2}$; depth 4; D. IX–12. A, II, 7. Scales 58. L. 2. Neosho R., S. Mo., scarce.

527. **O. virgatus** (Jordan). Form and appearance of *Catonotus flabellaris;* head long-pointed; jaws subequal; maxillary reaching pupil; preopercle crenulate; cheeks and opercles naked; a black humeral scale. Greenish, each scale with a dusky spot, these forming lengthwise stripes; sides with faint bars. D. and C. barred. Head $3\frac{2}{3}$; depth 5. D. IX–10. A. II, 8. Scales 58. L. $2\frac{1}{2}$. Rockcastle R., Ky. (Lat., streaked.)

297. CLARICOLA Jordan & Evermann (Lat., *clarus*, clear; *colo*, to inhabit)

a. Cheeks naked or nearly so; opercles scaly; gill membranes broadly joined.

528. **C. juliae** (Meek). Body deep, the back elevated; cheeks and breast naked; opercle with a few scales. Gill membranes broadly united across

isthmus; a black humeral scale; pectorals large, ventrals well separated. Greenish; fins yellowish; sides with crossbars and yellowish streaks along rows of scales. Head 4; depth 4. D. XI–12. A. II, 7. Scales 59. White R., Mo., scarce. (For Mrs. Julia Hughes Gilbert.)

529. **C. whipplii** (Girard). Body rather deep, compressed, with deep tail; mouth terminal, oblique; maxillary to eye, $3\frac{1}{2}$ in head. Gill membranes broadly joined. ♂ grayish, mottled with darker and with faint bars; sides with small, round scarlet spots; two orange blotches at base of C.; a black humeral scale; dorsals barred with dusky and orange; A. similar, but more orange; C. varied, its margin black. Head $3\frac{1}{2}$; depth $4\frac{3}{4}$. D. IX to XII–12 to 14. A. II. 7. Scales 60 to 70. Vert. 36. L. $2\frac{1}{2}$. Ozark region and S., abundant. (To Lieut. A. W. Whipple, U. S. A.)

aa. Cheeks, opercles, nape, and breast scaly; jaws equal; form robust; lateral line nearly complete; gill membranes little connected.

530. **C. squamiceps** (Jordan). Body less elongate than in *Catonotus*, the head shorter and thicker. Gill membranes not broadly joined. Dusky olive, without well-defined marks; sides mottled, with 6 crossbars; a black humeral scale. Head $3\frac{1}{3}$; depth 5. D. IX–12. A. II, 7. Scales 5–50–6. L. 3. S. Ind. and Ill. to W. Fla. A peculiar species, without near relatives. (Lat., *squama*, scale; *ceps*, head.)

298. CATONOTUS Agassiz (Gr., *κάτω*, low; *νῶτος*, back)

531. **C. flabellaris** (Rafinesque). Fan-tail Darter. Body long and low, the back not arched; head long and pointed; fins low; 1st D. in ♂ half as high as 2d; the spines with fleshy tips; spines higher in ♀; nape and throat naked; head entirely naked; lower jaw prominent; lateral line developed about half way. A conspicuous black humeral scale. Lateral line always incomplete, straight; gill membranes broadly united. Dusky olive, with dark longitudinal streaks, ♂ with dark crossbars; 2d D. and C. sharply barred; 1st D. in ♂ tipped with orange. Head 4; depth 5. D. VIII–12. A. II, 8. Scales 7–50–7. Vert. 33. L. $2\frac{1}{2}$. W. N. Y. to N. C., and W. in clear streams, abundant and variable; the typical form from Ind. E. (Subsp. **lineolatus** Agassiz, W. of L. Mich., has a black spot on each scale, these marks forming conspicuous streaks along side. Subsp. **cumberlandicus** Jordan & Swain, from Cumberland R., has thicker head, and the adult is almost plain olivaceous, except for the black humeral spot and the barred fins.) This is the most active and wary of the darters, and the most hardy in the aquarium. (Lat., *flabellum*, a fan.)

299. TORRENTARIA Jordan & Evermann (Lat., *torrens*, torrent)

532. **T. sagitta** (Jordan & Swain). Body slender, with long tail; head long, very slender, the snout sharp; mouth very large, oblique; maxillary reaching

front of pupil, 3¼ in head; cheeks, opercles, and nape naked, or very nearly so. Scales small, 63 to 73 in a longitudinal series; jaws subequal; fins high, a black humeral scale. ♂ green, with faint olive crossbars; a dark spot at base of C.; sides with orange spots; fins with orange shades. Head 3⅓; depth 4⅘. D. X–13. A. I, 10. Lat. l. 68 (48 tubes). L. 2½. Cumberland R., Ky. (Lat., arrow.)

300. HOLOLEPIS Agassiz (Gr., ὁλός, wholly; λεπίς, scaled) (*Copelandellus* Jordan & Evermann)

a. Top of head closely scaled.

533. **H. barratti** (Holbrook). Form of *Oligocephalus*, with the lateral line also incomplete, and distinctly arched. Gill membranes separate; black humeral scale present; cheeks, opercles, breast, nape, and whole *top of head closely scaled*. Dark brown, washed with pale red; a broad black lateral stripe, mottled with red; a black spot at base of pectoral; upper fins checkered with black; P. plain. Head XI–11. A. II, 7. Scales 3–48 to 56–10. Lowland swamps, from the Dismal Swamp, Va., to the Everglades. (*Copelandellus quiescens* Jordan.) (To Mr. Barratt, the collector of the types.)

aa. Top of head scaleless.

534. **H. fusiformis** (Girard). Body slender, fusiform; snout short, bluntish; mouth small, oblique; maxillary reaching beyond front of eye; eye large, longer than snout; C. rounded; A. spines small. Olivaceous, mottled with brownish; back with 12 green cross shades; sides with similar shades, sometimes with red; 1st D. black below, with reddish spots above. Head 4; depth 6. D. IX or X–10. A. II, 6. Scales 48 to 50. (10 to 20 pores.) Vert. 36 L. 2. Mass., S. to Texas, coastwise in lowland streams and mudholes. (*Boleichthys* Girard.) (Lat., fusiform.)

301. MICROPERCA Putnam (Gr., μικρός, small; πέρκη, perch)

535. **M. punctulata** Putnam. Least Darter. Body rather short and deep, compressed; snout somewhat decurved; cheeks naked; opercles scaly; nape and breast naked; lateral line entirely wanting; fins small; anal spines strong. Olivaceous, much speckled, and with zigzag markings; 2d D. and C. barred; a black humeral scale. Head 3¾; depth 4½. D. VI or VII–10. A. II, 6. Scales 34. Vert. 14 + 16 = 30. L. 1 to 1½. Smallest of the darters, and one of the smallest of fishes; common from Mich. to Minn. and S. In southern Texas occurs a similar genus, *Alvarius* Girard, with the species *lateralis* and *fonticola*, equally small and with but one anal spine. (Lat., finely spotted.)

Family XCVIII. PERCIDAE (The Perches)

Body elongate, with rather small, ctenoid, adherent scales; lateral line complete, not extending on caudal fin; mouth large, the teeth sharp, sometimes with canines; no supplemental maxillary; preopercle strongly serrate, the lower serrae turned forward; opercle with a flat spine; gills 4, a slit behind the 4th; gill membranes free from isthmus; gill rakers slender, toothed; branchiostegals 7; pseudobranchiae well developed; lower pharyngeals separate, with sharp teeth; air bladder small, adherent to abdominal walls. Fins usually large; dorsal fins separate, the first with about 13 spines; anal spines 2; V. thoracic, I, 5; intestinal canal short; pyloric caeca few; no anal papilla. Vertebrae more numerous than in *Serranidae*, 40 to 45. Species rather few, in the fresh waters of the eastern United States, of Europe, and of northern Asia. Some of the species reach a considerable size and all are valued as food.

a. Canine teeth none; body oblong; ventrals near together. . . . . Perca, 302.
aa. Canine teeth on jaws and palatines; body elongate; ventrals wide apart.
b. Pyloric caeca 3, subequal, each about as long as stomach; dorsal with 21 soft rays. Stizostedion, 303.
bb. Pyloric caeca 4 to 8, unequal, the four longest much shorter than stomach; dorsal with 18 soft rays. . . . . Cynoperca, 304.

302. PERCA (Artedi) Linnaeus (Gr., πέρκη, perch, from περκός, dusky)

536. **P. flavescens** (Mitchill). Yellow Perch. Ringed Perch. Body oblong, somewhat compressed, the back elevated; cheeks scaly; opercles mostly naked, striate; premaxillaries protractile, preorbital serrate; snout projecting; maxillary reaching middle of pupil; top of head rugose; gill rakers stout, the longest but 3 times as high as broad. Dark olivaceous, sides golden yellow; 6 to 8 broad dark crossbars from back to below middle of sides; lower fins orange, upper olivaceous; spinous D. without distinct black spot. Head $3\frac{1}{4}$; depth $3\frac{1}{4}$. D. XIII–1, 14. A. II, 7. Scales 5–55–17. Vert. 41. Pyloric caeca 3. L. 15. S. Canada, S. to S. C., E. of Alleghenies, and to Ohio and Okla. in Miss. Valley; abundant. (Lat., growing yellow.)

303. STIZOSTEDION[1] Rafinesque (Pike Perches) (Gr., στιζω, to prick; στεθός, breast. "The name means pungent throat." *Raf.*)

537. **S. vitreum** (Mitchill). Wall-eye. Glass-eye. Pike Perch. Jack Salmon. Doré. Body elongate, growing deeper with age, the back more arched than in *Cynoperca;* head long, sub-conic; cheeks, opercles, and top of head more or less scaly; opercle with radiating striae, ending in spinules; D. spines high, soft D. nearly as long as spinous. Dark olive, always mottled with brassy; sides of head vermiculated; 1st D. with a large jet-black blotch pos-

[1] *Stizostedion* differs from the European genus *Sandrus* Oken (*Lucioperca* Cuvier) by the widely separated ventrals and weaker spines.

teriorly, otherwise nearly plain dusky; 2d D. and C. mottled olive and yellowish; base of P. without black spot; ventrals yellowish. Head 4⅔; depth 4 to 6. A. II, 12. Lat. l. 90. Pyloric caeca 3. L. 3 feet. Canada and Miss. Valley, E. to N. B. and Va.; commonest N., where it is one of the leading food fishes. Absurdly called "Salmon" in parts of the South.

538. S. glaucum Hubbs. Blue Pike. Flesh less firm than in *S. vitreum*, the color grayish blue without brassy shades; lower fins bluish; eye very large, close set, the bony interspace 1½ to 2 in eye. Smaller, rarely reaching 18 inches. Lake Erie. (Lat., gray-blue.)

304. CYNOPERCA Gill & Jordan (Gr., κύων, dog; πέρκη, perch)

539. **C. canadensis** (C. H. Smith). Sauger. Sand Pike. Hornfish. Body elongate, more terete than in the preceding, the flesh more translucent; head depressed, pointed; opercular spines variable. Eye small, 5 in head. Olive-gray, sides brassy or orange, with dark mottlings, more distinct in young; 1st D. with 2 or 3 rows of round, black spots; no black blotch on last spines; 2d D. with 3 irregular rows of dark spots; a large black blotch on base of P.; C. yellowish. Head 3½; depth 4½ to 5. A. II, 12. Lat. l. 95. Vert. 45. L. 18. Eastern Canada. The typical form in the St. Lawrence region has bones of the head especially rough, the head more scaly, and about 4 opercular spines. Subspecies **grisea** (De Kay) is the common form from Ohio to Minnesota, abundant in the Great Lakes. It differs from the true *canadensis* in having the head smoother, less scaly and the number of spinules on the opercle fewer. Subsp. **borea** of the upper Missouri R., etc., has a slenderer and more snake-like head.

Family XCIX. MORONIDAE (The River Basses)

Body oblong, with large, firm, ctenoid scales; mouth large, with uniform, pointed teeth, no canines; teeth on vomer and palatines; maxillary broad, without supplemental bone, not slipping for its whole length beneath the preorbital; gill rakers stiff, toothed; gills normal; pseudobranchiae large; lower pharyngeals separate, with pointed teeth; gill membranes separate; B. normally 7. Preopercle serrate; opercle with flat points or spines. Lateral line present, not extended on the caudal. Dorsal fins separate or slightly connected, anal shortish, with 3 spines. V. normal. Tail stout, its fin forked. Vertebrae 24. Intestine short, the stomach caecal, with pyloric appendages. Carnivorous fishes, of the fresh waters of northeastern America, Russia, and Siberia, some of them anadromous, living in bays and ascending streams to spawn.

a. Dorsal fins separate; spines ~~weak~~ strong; anal rays about III, 12, the spines graduated; lower jaw projecting.

b. Base of tongue with two patches of teeth, body elongate, little compressed. Roccus, 305.

bb. Base of tongue with one patch of teeth, body deep, compressed. . . LEPIBEMA, 306.
aa. Dorsal fins joined; spines strong; anal rays III, 9, the spines not graduated; jaws subequal; base of tongue toothless.
c. Spines very strong, the second anal spine 2½ to 3 in head; body strongly striped. CHRYSOPERCA, 307.
cc. Spines more slender, the second anal spine 2 to 2½ in head; body scarcely striped. MORONE, 308.

305. ROCCUS Mitchill (Eng., rock)

540. **R. saxatilis**[1] (Walbaum). STRIPED BASS. ROCK BASS. ROCKFISH. ROCK. Body oblong, growing deep with age; spines slender, the 2d anal spine 5 to 7 in head. Pale yellowish olive, sides paler, with 7 to 9 black lengthwise stripes. Head 3½; depth 3½. D. IX–I, 12. A. III, 11. Lat. l. 65. L. 3 to 5 feet. Gulf of St. Lawrence to La., entering rivers to spawn. (Introduced into California.) One of our finest game fishes. (Lat., of the rocks.)

306. LEPIBEMA Rafinesque (Gr., λεπίς, scale; βῆμα, a staircase; from the scales on base of D.)

541. **L. chrysops** (Rafinesque). WHITE BASS. Body deep; the back arched; the sides compressed; 2d A. spine 3 in head. Greenish, sides silvery, with several dusky longitudinal streaks, those below lateral line more or less interrupted. Head 3⅓; depth 2½. D. IX–I, 14. A. III, 12. Lat. l. 55. L. 15. Great Lakes and upper Miss. Valley, not entering the sea, rather common. (Gr., χρυσός, gold; ὤψ, eye.)

307. CHRYSOPERCA Fowler (Gr., χρυσός, golden + *Perca*)

542. **C. interrupta** (Gill). YELLOW BASS. Body oblong, ovate, the back elevated; anterior profile concave; 2d A. spine about 2 in head; spines very strong. Brassy, sides with 7 very distinct black stripes, those below lateral line interrupted behind, and beginning lower down. Head 3; depth 2⅔. D. IX–I, 12. A. III, 9. Lat. l. 50. L. 12. Lower Miss., N. to Brookville, Ind., in rivers only. (Lat., interrupted.)

308. MORONE Mitchill (name unexplained)

543. **M. americana** (Gmelin). WHITE PERCH. Body oblong, not strongly compressed; 2d A. spine about 3 in head; spines strong. Olivaceous, sides silvery. Head 3; depth 3. D. IX–I, 12. A. III, 9. Lat. l. 50. L. 10. Nova Scotia to Fla., common in estuaries, ascending streams. A smaller fish than the others.

FAMILY C. SERRANIDAE (THE SEA BASSES)

Body oblong, with adherent ctenoid scales; dorsal fins continuous, not deeply notched; maxillary without supplemental bone; villiform teeth on jaws,

[1] The name *R. lineatus*, in common use, apparently cannot be retained, as *Sciaena lineata* Bloch, on which it rests, is a bad figure of the European bass, *Dicentrarchus lupus* L.

vomer, and palatines, no depressible teeth; temporal crests on cranium small; gill rakers rather short; supraoccipital crest not much encroaching on frontal region; dorsal spines 10. Fishes of warm seas, the species numerous; smaller than most of the *Epinephelidae;* valued as food.

a. Smooth area on cranium short and small. C. not lunate, usually ending in 3 points; teeth small. . . . . CENTROPRISTES, 309.

309. CENTROPRISTES Cuvier (Gr., κέντρον, spine; πρίστης, saw)

544. **C. striatus** (Linnaeus). BLACK SEA BASS. BLACKFISH. BLACK WILL. HANNAHILL. Body robust; head large; mouth moderate; teeth small, in broad bands; dorsal spines strong, with short filamentous appendages; P. long. Blackish, more or less mottled, with traces of pale streaks along the rows of scales; D. with rows of whitish spots; young with dark cross-shades and dusky lateral band. Head $2\frac{3}{4}$; depth $2\frac{3}{4}$. D. X, 11. A. III, 7. Lat. l. 50. L. 14. Mass. Bay to Fla., common, strictly marine. (*C. atrarius* (Linnaeus).) (Lat., striped.)

NOTE. Several other species of *Serranidae* occur as more or less frequent stragglers as far N. as N. C. or even Mass., as do also species of the related families *Apogonidae* and *Priacanthidae.*

FAMILY CI. EPINEPHELIDAE (THE GREAT SEA BASSES)

This large family of marine fishes differs from the *Serranidae* in the presence of a distinct supplemental bone in the maxillary and in the dentition, there being usually canine teeth, and the inner series of teeth in the jaws being more or less depressible. No smooth area on vertex. The dorsal spines vary greatly in number, but there are almost never 10. Species numerous, in all tropical seas, valued as food, some of them reaching an immense size.

a. Dorsal rays mostly XI, 16; anal rays II, 8; canines moderate. . . EPINEPHELUS, 310.

310. EPINEPHELUS Bloch (GROUPERS; GARRUPAS) (Gr., ἔπι, above; νέφελος, clouded; the eye in the type species apparently clouded over)

545. **E. morio** (Cuvier and Valenciennes). RED GROUPER. Preopercular angle little salient, without enlarged teeth. Second dorsal spine elevated, not lower than 3d or 4th; C. lunate. Brown, clouded with whitish; lower parts flushed with orange-red; small dark spots about eye; vertical fins broadly edged with black. Head $2\frac{1}{3}$; depth 3. D. XI, 17. A. III, 9. Lat. l. 106. L. 3 feet. West Indies, sometimes N. to Woods Hole. Numerous species of *Epinephelus* and related genera occur off our Southern coast, and come to the Northern markets, and several of them range N. as more or less frequent stragglers to N. C. or even to New England. (*mérou,* a French name, allied to Lat., *morrhua,* cod.)

Family CII. LOBOTIDAE (The Tripletails)

Closely allied to the *Epinephelidae*, from which they differ in the absence of teeth on the vomer and palatines. The lips are thick, the upper jaw very protractile, the lower longer, and the bases of the high soft dorsal and anal thickened and scaly. Large fishes, found in most warm seas, the species few.

311. LOBOTES Cuvier (Gr., λοβότης, lobed)

546. **L. surinamensis** (Bloch). Flasher. Tripletail. Head small, the anterior profile concave, the back elevated. Blackish above, sides grayish, often blotched with yellowish. Head 3; depth 2½. D. XII, 18. A. III, 11. Lat. l. 47. L. 3 feet. Tropics, widely diffused, frequently N. to Woods Hole.

Family CIII. LUTIANIDAE (The Snappers)

Body oblong or elevated, with adherent, ctenoid scales. Mouth terminal, the teeth villiform, with canines, present on vomer and palatines, no incisors nor molars. Premaxillaries protractile; maxillary for its whole length slipping into a sheath formed by the edge of the preorbital; gills and gill membranes normal; pseudobranchiae large. Preopercle more or less serrate; opercle unarmed. Dorsal fin continuous, with 8 to 13 spines; anal spines 3. V. normal, usually with an enlarged scale at base; lateral line continuous, not extending on C. Intestines short; pyloric caeca few. Air bladder present. Carnivorous fishes of the warm seas, many of them from the West Indies reaching our markets; all valued as food.

a. Dorsal fin continuous; top of head naked; one oblique band of scales on side of nape; soft dorsal scaly. (*Lutianinae.*)
b. Interorbital area not flat; fronto-occipital crest not continued forward to snout.
c. Pterygoid teeth wanting; C. lunate; D. mostly X, 14. . . . . Lutianus, 312.
cc. Pterygoid teeth present; C. deeply forked; D. XII, 11. . . Rhomboplites, 313.

312. LUTIANUS Bloch (*Lutjang*, a Hindu name, hence often written, *Lutjanus*)

a. Anal fin low, rounded; color chiefly greenish.

547. **L. griseus** (Linnaeus). Mangrove Snapper. Gray Snapper. Lawyer. Caballerote. Snout pointed; mouth large; lower jaw not projecting; canines strong; vomerine teeth in a ⅄-shaped patch; preorbital deep; rows of scales of sides of back becoming oblique and irregular behind. Dark green, reddish below; young with dusky streaks; vertical fins blackish, tinged with red in life. Head 2¾; depth 2¾ to 3. D. X, 14. A. III, 8. Scales 6–50–12. L. 18. West Indies, N. to Woods Hole; very common S., especially alongshore among mangroves. (Lat., gray.)

aa. Anal fin high, angulated, the middle rays elevated; color chiefly red.

548. **L. campechanus** (Poey). Red Snapper. Body robust; upper canines strong, lower small; teeth and scales much as in *L. griseus*. Rose-red, nearly uniform, young with a dark blotch on lateral line. Head $2\frac{2}{5}$; depth $2\frac{2}{3}$. D. X, 14. A. III, 9. Scales 7–60–15. L. 30. West Indies, etc., rarely N. to Block Island (Goode), abundant on the Gulf Coast, in rather deep water, a valued foodfish, common in city markets. Our species is now regarded as distinct from the Red Snapper (*L. aya* (Bloch)), of Brazil. The American group called *Neomaenis* Girard, is apparently not separable from *Lutianus*. (*L. blackfordi* Goode & Bean.) (From Campeche, the type locality.)

Note. The young of other species of snappers often wander N. along our coast

313. RHOMBOPLITES Gill (Gr., *ῥόμβος*, rhomb; *ὁπλίτης*, armed)

549. **R. aurorubens** (Cuvier & Valenciennes). Cagon de lo Alto. Body elongate; interorbital very convex. Vermilion, paler below; sides with narrow sinuous streaks of golden yellow. N. C. to Brazil. (Lat., *aureus*, golden; *rubens*, reddish.)

Family CIV. HAEMULIDAE (The Grunts)

This large family differs from the *Lutianidae*, mainly in the absence of teeth on the vomer and palatines. As in other fishes related to the *Sparidae*, the maxillary slips into a sheath below the preorbital. Teeth all pointed, no incisors nor molars; preopercle serrate. Otherwise much like the *Sparidae*. Carnivorous fishes of the tropics, mostly of considerable size and valued as food.

a. Mouth small; chin with a large pore; anal fin long, its rays III, 11, to III, 14, its spines small, graduated. . . . . Orthopristis, 314.

314. ORTHOPRISTIS Girard (Gr., *ὀρθός*, straight; *πρίστις*, saw)

550. **O. chrysopterus** (Linnaeus). Pigfish. Sailor's Choice. Body compressed, the head long; mouth low, with small teeth; spines slender. Grayish, sides with many yellow spots, forming series along the rows of scales, those above lateral line oblique, those below parallel with lateral line; fins and head spotted. Head $3\frac{1}{3}$; depth 3. D. XII, 16. A. III, 12. Lat. l. 57 (rows). L. 12. Woods Hole to Texas and Cuba, common S. (Numerous species belonging to *Haemulon*, and allied genera, are found S. of Cape Hatteras, and some of them range, more or less as stragglers, farther to the N.) (Gr., *χρυσός*, gold; *πτερόν*, fin.)

Family CV. SPARIDAE (The Porgies)

The *Sparidae* differ from the *Haemulidae* mainly in the teeth, those on the sides of the jaw being enlarged, blunt molars. Preopercle always entire.

Body broad, covered with large, firm scales, which are never rough. Large fishes, chiefly of temperate seas, most of them highly valued as food. Several species other than those mentioned below occur as stragglers along our coast.

a. Second interhaemal spine normal, not "pen-shaped"; front teeth broad, incisor-like; no canines; first spine-bearing interneural developed as a forward-directed spine before D.
b. Incisors deeply notched, rather broad; occipital and temporal crests of skull nowhere coalescent; interorbital area not swollen, its bones thin, transversely concave. LAGODON, 315.
bb. Incisors entire; occipital and temporal crests coalescent anteriorly, both merging into the gibbous interorbital area, the bones of which are honeycombed.
c. Procumbent spine before dorsal present; body barred with black; no blotch on back of tail. . . . . ARCHOSARGUS, 316.
cc. Procumbent spine before dorsal wanting; silvery, a black blotch on back of tail. DIPLODUS, 317.
aa. Second interhaemal spine enlarged, hollowed anteriorly, pen-shaped, receiving the posterior end of the air bladder in its anterior groove; front teeth incisor-like, but very narrow; an antrorse spine before D.; lateral crest not coalescing with occipital crest; interorbital area flattish. . . . . STENOTOMUS, 318.

315. LAGODON Holbrook (Gr., λαγώς, hare; ὀδών, tooth)

551. **L. rhomboides** (Linnaeus). PINFISH. CHOPA-SPINA. BREAM. SAILOR'S-CHOICE. Body elliptic-ovate, compressed; head pointed; upper molars in two rows. Olive, sides silvery, with faint stripes of blue and golden; 6 dark vertical bars, growing faint with age; a large dark blotch above P.; fins streaked with yellowish; 2d A. spine scarcely enlarged. Head $3\frac{1}{3}$; depth $2\frac{1}{3}$. D. XII, 11. A. III, 11. Scales 8–68–18. L. 6. Woods Hole to Cuba and Texas; very common S. (Gr., ῥομβός, rhomb; εἶδης, like.)

316. ARCHOSARGUS Gill (Gr., ἀρχων, ruler + *Sargus*, a synonym of *Diplodus*)

552. **A. probatocephalus** (Walbaum). SHEEPSHEAD. Body deep, robust, the back arched; occipital crest strong; 2d A. spine much enlarged. Gray with 7 broad black crossbars; no gilt streaks nor shoulder spot. Head $3\frac{1}{3}$; depth 2. D. XII, 11. A. III, 10. Scales 7–48–15. L. 30. Cape Cod to Texas, largest of our *Sparidae* and one of the best of our food fishes (Gr., πρόβατον, sheep; κεφαλή, head.)

317. DIPLODUS Rafinesque (*Sargus* Cuvier)
(Gr., διπλόος, double; ὀδούς, tooth; two kinds of teeth)

553. **D. holbrookii** (Bean). Form regularly elliptical; color silvery, the back blue; a broad black bar across caudal peduncle above; opercle bordered with black; a black spot on upper base of pectoral. Head $3\frac{2}{3}$; depth $2\frac{1}{3}$; D. XII, 14. A. III, 13. Scales 56. L. 12. Carolina Coast, N. to Cape Henry, common S. (For J. E. Holbrook.)

318. STENOTOMUS Gill

(*Stenesthes* Jordan, there being an earlier genus, *Stenotoma*)
(Gr., στενός, narrow; τομός, cutting)

554. **S. chrysops** (Linnaeus). Scup. Scuppaug. Porgy. Body ovate, elliptical, compressed, the back elevated, the depth uniform from first to 11th dorsal spine, anterior profile, steep; incisors very narrow, resembling canines. Snout short, $2\frac{1}{2}$ in head. Third dorsal spine elevated; 2d A. spine slightly enlarged. Pectoral shorter than head, $3\frac{1}{3}$ in body. Brownish olive; sides silvery, nearly plain; vertical fins somewhat mottled; young faintly barred. Head $3\frac{1}{4}$; depth 2. D. XII, 12. A. III, 11. Scales 6–49–16. L. 12. Cape Cod to Va. or beyond, common N. A valued pan fish. (Farther south occur numerous species of the related genus *Calamus*, with the front teeth not at all compressed, but with the interhaemals quill-shaped, as in *Stenotomus*.) (Gr., χρυσός, yellow; ὤψ, eye.)

555. **S. aculeatus.** (Cuvier & Valenciennes.) Southern Scup. Body more elongate, the depth decreasing gradually from 1st dorsal spine to caudal peduncle; front not steep; snout long, half head. Pectoral as long as head. 2d D. spine half head. Silvery, with golden streaks. Head 3; depth $2\frac{1}{5}$. D. XII, 12. A. III, 11. Scales 8–54–15. L. 12. Va. to Texas, common S., replacing *S. chrysops*. (Lat., sharp.)

Family CVI. KYPHOSIDAE (The Rudder Fishes)

This family is allied to the *Sparidae*, differing in the dentition, the front teeth being all incisor-like, and sometimes movable, no conical teeth and no molars; soft fins densely scaly. Intestines long, with many pyloric caeca. Herbivorous fishes of the warm seas, the species numerous and valued as food.

a. Vomer with teeth; incisors entire at tip, with horizontal backward projecting roots; band of small teeth behind them narrow. . . . . Kyphosus, 319.

319. KYPHOSUS Lacépède (*Pimelepterus* Lacépède) (Gr., κύφος, gibbous)

556. **K. sectatrix** (Linnaeus). Rudder Fish. Chopa. Chub. Body ovate, compressed; mouth small; interorbital space gibbous, the snout truncate; fins all very low; C. forked; head, body, and fins all closely scaled. Dusky gray, sides with many pale stripes, preorbital with a silvery streak. Head $4\frac{1}{5}$; depth $2\frac{1}{4}$; D. XII, 12. A. III, 11. Scales 56; West Indies, occasionally N. to Cape Cod. (Lat., follower.)

557. **K. incisor** (Cuvier & Valenciennes). Chopa Amarilla. Similar to *sectatrix* but slenderer and with more scales (65) and fin rays (D. XI, 14; A. III, 13), and with bright yellow stripes. Tropical Atlantic, rare N. to Nantucket. (Lat., one who cuts, from the teeth.)

Family CVII. BRANCHIOSTEGIDAE (The Blanquillos)

Body rather elongate, moderately compressed, covered with small scales. Bones of head not cavernous, mostly unarmed. Mouth moderate, terminal, with rather strong pointed teeth in the jaws; premaxillary with a posterior canine; maxillary without supplemental bone, not slipping below preorbital. Gills normal. Scales ctenoid; lateral line complete. Dorsal continuous, with 6 to 9 slender spines; anal with one or two spines, ventrals I, 5. Vertebrae more than 24. Caudal emarginate. Fishes of moderate size, in the warm seas or in ocean depths; flesh very white, of good quality. Species few.

a. Nape with a large adipose appendage; a fleshy prolongation on each side of the lip; soft dorsal and anal short, each of 13 to 15 rays, preopercle serrulate. . Lopholatilus, 320.

320. LOPHOLATILUS Goode & Bean (Gr., λοφός, crest + *Latilus*, an old name, a synonym of *Branchiostegus*)

558. **L. chamaeleonticeps** Goode & Bean. Tilefish. Teeth strong; color brilliant, roseate and golden. Head 3; depth 3½. D. VII, 15. A. III, 13. Scales 93. Off Cape Cod and S., in rather deep water, once abundant, afterward (1882) millions of them died for some unknown reason; the species now rare. Excellent as food. (Lat., chameleon-headed.)

Family CVIII. MULLIDAE (The Surmullets)

Body oblong, with large, ctenoid scales; head with large scales; profile of head blunt; mouth small, the teeth various, but short, premaxillaries protractile; maxillary simple, partly hidden by the broad preorbital; throat with 2 long barbels, used as feelers. Dorsals 2, well separated, the 1st of about 7 high spines, the 2d short; A. short, with 2 small spines; V. and gill structures normal. Tropical seas. Carnivorous fishes of moderate size, valued as food.

a. Teeth in lower jaw and on vomer and palatines, none in upper jaw; interorbital space flat and broad; opercle without spine. . . . . Mullus, 321.
aa. Teeth in both jaws but none on vomer and palatines; interorbital narrow and concave; opercle with a spine. . . . . Upeneus, 322.

321. MULLUS (Artedi) Linnaeus (Ancient name from Gr., μύλλος, lip)

559. **M. auratus** Jordan & Gilbert. American Surmullet. Red; sides with 3 darker stripes; barbel 1⅓ in head; eye 5. Head 3½; depth 4. D. VII–I, 8. A. II, 6. Lat. l. 36. L. 10. A small fish, closely related to the valued surmullet of Europe (*Mullus surmuletus* Linnaeus). Very rare on our coasts. (Woods Hole; N. Y.; Pensacola.)

322. UPENEUS Cuvier (an old name for some fish)

560. **U. maculatus** (Bloch). Red Goatfish. Red; sides with bluish longitudinal lines; 3 black blotches along lateral line; soft D. and C. without dark bars. Head $3\frac{1}{4}$; depth 4; eye 4; maxillary not reaching orbit. D. VII, or VIII–I, 8; A. II, 6; scales 30 or 31. W. I., rare N. to N. J. (Lat., spotted.)

561. **U. phillipsi** Fowler. Greenish gray, with a salmon-colored streak along lateral line and flecks of same color below; soft D. and C. with black bars. Head $3\frac{1}{2}$; depth $3\frac{2}{5}$. C. VIII–I, 8; A. I, 6; scales 30. Known only from N. J., doubtless as a straggler from the S. (To Dr. Richard J. Phillips.)

Family CIX. SCIAENIDAE (The Drums)

Body more or less elongate, with weakly ctenoid scales. Lateral line continuous to the end of caudal fin. Head covered with scales; cranium cavernous, the muciferous system highly developed, surface of the skull very uneven; chin with pores; mouth various; teeth all pointed, sometimes with canines; maxillary without supplementary bone, slipping beneath preorbital; premaxillaries protractile; gills and gill structures normal. D. deeply notched, its soft part long; A. short, with 1 or 2 spines; V. normal. Ear bones very large. Vertebrae 24; air bladder (sometimes wanting) usually large and complicated, its structure enabling the fish to make grunting or drumming sounds. Carnivorous fishes, often of large size, abounding in all warm seas, on sandy shores, never about rocks or coral; two genera confined to fresh waters.

a. Vertebrae typically 14 + 10, the number in the abdominal region always greater than that in the caudal; lower jaw prominent; teeth all pointed; body elongate; mouth large; preopercle entire; anal spines very weak. (*Otolithinae.*)

b. Anal moderate, of 7 to 13 rays, its length not half that of soft D.; tip of upper jaw with 2 pointed canines; none at tip of lower.

c. Soft rays of dorsal and anal closely scaled; gill rakers long and slender. Cynoscion, 323.

cc. Soft rays of dorsal and anal scaleless; gill rakers short and thick. Eriscion, 324.

aa. Vertebrae typically 10 + 14; second anal spine well developed. Body less elongate, the mouth smaller, and the snout more blunt.

d. Dorsal spines well separated; dorsal soft rays fewer than 35 (in all our species).

e. Lower pharyngeals separate. (*Sciaeninae.*)

f. Lower jaw without barbels.

g. Teeth well developed, permanent in both jaws; lower pharyngeals narrow, with sharp teeth.

h. Gill rakers slender, rather long; mouth oblique. A. inserted rather posteriorly; preorbital narrow; slits and pores of upper jaw little developed.

i. Head not very broad, the interorbital not notably spongy or deeply cavernous.

j. Preopercular margin almost entire, without bony serrae; premaxillary teeth in one series. . . . . Larimus, 325.

jj. Preopercular margin serrate, the lowermost spine turned downward; premaxillary teeth in a band. . . . . Bairdiella, 326.

ii. Head very broad and spongy above; lowermost spinule of preopercle not directed downward. . . . . Stellifer, 327.

hh. Gill rakers rather short and thick; anal farther forward; snout with large pores, and 2 to 4 slits on its edge; mouth inferior; preorbital broad; preopercle weakly serrate; caudal truncate. . . . . Sciaenops, 328.

gg. Teeth very small, subequal, those in lower jaw lost with age; lower pharyngeals broad, with paved teeth; gill rakers short, but slender. . LEIOSTOMUS, 329.
ff. Lower jaw with one or more barbels (otherwise essentially as in *Sciaenops*).
k. Lower jaw with several slender barbels on its branches; preopercle serrate. MICROPOGON, 330.
kk. Lower jaw with one short thick barbel at its tip; no air bladder; anal spine single; body long and low; preopercle crenulate.
l. Gill rakers obsolete, reduced to tubercular prominences. MENTICIRRHUS, 331.
ll. Gill rakers short and slender. . . . . UMBRULA, 332.
ee. Lower pharyngeals completely united, very large, with coarse, paved teeth; snout, etc., as in *Sciaenops*. (*Aplodinotinae.*)
m. Barbels present, numerous, along the branches of lower jaw; preopercle nearly entire; species marine. . . . . POGONIAS, 333.
mm. Barbels wanting; preopercle obscurely serrate. Species of fresh water only. APLODINOTUS, 334.
dd. Dorsal spines close together; dorsal soft rays more than 35 (*Equetinae*). EQUETUS, 335.

323. CYNOSCION Gill (Gr., *κύων*, dog; *σκιόν*, *Sciaena*, the Modern Greek name of *Umbrina cirrhosa*)

562. **C. regalis** (Bloch & Schneider). WEAKFISH. SQUETEAGUE. Silvery, brownish above, and with bright reflections, back and sides with irregular dark spots forming undulating streaks; fins without distinct spots; snout sharp, eye moderate, 5 to 7 in head. Head $3\frac{1}{2}$; depth $4\frac{1}{4}$. D. X–I, 29. A. I, 13. Lat. l. 80. L. $2\frac{1}{2}$ feet. Mass. Bay to Fla. An abundant and most excellent foodfish, the flesh easily torn by its vicious and powerful rival, the Bluefish (*Pomatomus*). (Lat., kingly.)

563. **C. nothus** Holbrook. SILVER SQUETEAGUE. BASTARD TROUT. Similar to *regalis*, but with only 9 to 11 soft anal rays, different proportions and a more silvery and less spotted color. Va. to Texas. (Gr., *νόθος*, bastard.)

324. ERISCION Jordan & Evermann (Gr., *ἐρι*, very; *σκιόν*, for *Sciaena*)

564. **E. nebulosus** (Cuvier & Valenciennes). SPOTTED WEAKFISH. SEA TROUT. Silvery, back and upper fins with many conspicuous round black spots; dorsal and anal without scales. Head $3\frac{1}{4}$; depth 5. D. X–I, 25. A. I–10. Scales 85. L. 2 feet. N. Y. to Texas, common S. An excellent foodfish. (All these fishes are absurdly called "Trout" in the Southern States, — a name also applied in the same regions to the Black Bass.) (Lat., cloudy.)

325. LARIMUS Cuvier & Valenciennes (old name for some fish.)

565. **L. fasciatus** Holbrook. Snout very short and blunt, $5\frac{1}{2}$ in head; eye about equal in width to nearly flat interorbital. Grayish olive, grading to silvery below, with about 8 dark bars. D. X–I, 24 to 26; A. II, 5 or 6. Mass. to Tex., rare N. (Lat., banded.)

326. BAIRDIELLA Gill (To Spencer Fullerton Baird)

566. **B. chrysura** (Lacépède). Silver Perch. Yellowtail. Mademoiselle. Jaws subequal; teeth in lower jaw mostly in one series; 2d A. spine rather strong, $2\frac{1}{3}$ in head; eye large. Greenish, sides plain silvery; scales and fins much punctulate; lower fins yellow. Head $3\frac{1}{3}$; depth $2\frac{3}{4}$. D. XII, 22. A. II, 9. Lat. l. 50. L. 9. Cape Cod to Texas, abundant S. (Gr., *χρυσός*, golden; *οὐρά*, tail.)

327. STELLIFER Oken (Lat., *stella*, star; *fero*, I bear)

567. **S. lanceolatus** (Holbrook). Interorbital 3 in head. Caudal long and lanceolate. Grayish olive, with many black dots on sides. N. C. to Texas. (Lat., spear-shaped.)

328. SCIAENOPS Gill (*Sciaena*, a related genus, from Gr., *σκία*, shade; *ὤψ*, appearance)

568. **S. ocellata** (Linnaeus). Redfish. Channel Bass. Head long; eye small; preopercle serrate in young, the teeth disappearing with age; body elongate, little compressed; mouth large, nearly horizontal; teeth in both jaws in bands, the outer enlarged above; anal spines moderate. Grayish silvery, with dark points on the scales forming undulating brown streaks; a large jet-black spot edged with orange on base C. above, this sometimes duplicated. Head $3\frac{1}{3}$; depth $3\frac{1}{2}$. D. X–I, 24. A. II, 8. Scales 4–50–7. L. 5 feet. Southern Coast to Gulf of Mexico, N. to Cape Cod. An important food fish S. (Lat., eyed.)

329. LEIOSTOMUS Lacépède (Gr., *λεῖος*, smooth; *στόμα*, mouth)

569. **L. xanthurus** Lacépède. Spot. Goody. Lafayette. Post Croaker. Compressed; profile steep; snout blunt, teeth small, the lower jaw toothless; fins low. Bluish, sides with 15 dark oblique bars; a round black spot behind shoulder. Head $3\frac{1}{3}$; depth 3. D. X–I, 32. A. II, 12. Lat. l. 60. L. 12. Cape Cod to Texas, common S., superior as a pan fish. (Gr., *ξανθός*, yellow; *οὐρά*, tail, but the C. is never yellow.)

330. MICROPOGON Cuvier & Valenciennes (Gr., *μικρός*, small; *πώγων*, beard)

570. **M. undulatus** (Linnaeus). Croaker. Roncador. Body rather elongate, with long head and rather large mouth. Grayish silvery, back and sides with undulating dark streaks; dorsals with lines of dots. Head $3\frac{1}{3}$; depth $3\frac{1}{3}$. D. X–I, 28. A. II, 7. Lat. l. 54. L. 18. Mass. to Texas. (Lat., wavy.)

331. MENTICIRRHUS Gill (Lat., *mentum*, chin; *cirrhus*, barbel)

571. **M. americanus** (Linnaeus). Sand Whiting. Spinous dorsal low, the spines barely reaching soft rays. Gill rakers obsolete; lower pharyngeals narrow, their teeth slender; outer teeth of upper jaw enlarged; scales on breast large; maxillary reaching beyond front of eye, more than ⅓ head. Outer teeth of upper jaw very strong; lower lobe of C. not black. Silver-gray, usually with faint oblique bars; snout projecting. Head 3⅓; depth 4. D. X–I, 25. A. I, 7. Lat. l. 65. N. J. to Brazil, abundant S. (*M. alburnus* L.)

572. **M. saxatilis** (Bloch). Kingfish. Barb. Sea Mink. Spinous D. high, the spines reaching past first soft rays. Outer teeth of upper jaw little enlarged; lower lobe of C. mostly black. Dusky gray, the back and sides with oblique dark cross-bands; one at the nape vertical, forming with the next a V-shaped blotch; a dark lateral streak, extending on C. Head 4; depth 4½. D. X–I, 26. A. I, 8. Scales 7–53–14. L. 18. Maine to Pensacola, common N., a valued food fish. (Lat., living among rocks, the name arising from confusion with *Roccus;* but none of the *Sciaenidae* frequent rocks.)

332. UMBRULA Jordan & Eigenmann (Diminutive from *Umbrina*, an allied genus)

573. **U. littoralis** (Holbrook). Silver Whiting. Surf Whiting. Gill rakers present, small; lower pharyngeals broad, their teeth mostly molar; outer teeth in jaws scarcely enlarged; scales on breast small. Snout projecting, 3½ in head; maxillary to eye, 3½ in head. Silvery-gray, almost plain; tip of C. black. Head 3½; depth 4⅖. D. X–I, 24. A. I, 7. Scales 6–53–12. L. 18. Va. to Texas, common S. in surf. (Lat., of the shore.)

333. POGONIAS Lacépède (Gr., πωγωνίας, bearded)

574. **P. cromis** (Linnaeus). Drum. Sea Drum. Robust; 2d A. spine large. Silver-gray or brassy; 4 or 5 dark vertical bars, lost with age. Hend 3⅓; depth 2½. D. X–1, 20. A. II, 6. Lat. l. 50. L. 4 feet, reaching 146 lb. (St. Augustine, Fla.). Mass. Bay to Brazil. A coarse fish, little valued as food. (Old name (chromis) of some fish, from Gr., χρέμω, to grunt or croak.)

334. APLODINOTUS Rafinesque (*Amblodon* Rafinesque)
(Gr., ἁπλοῦς, simple; νῶτος, back; the dorsal fins somewhat connected)

575. **A. grunniens** (Rafinesque). Fresh-water Drum. Gaspergou. Lake Sheepshead. Croaker. Bubbler. Thunder Pumper. Snout blunt; back compressed; 2d A. spine very strong; C. rhombic. Grayish silvery, more or less dotted. Head 3½; depth 3. D. IX–1, 30. A. II, 7. Lat. l. 55. L. 2 feet or more. Great Lakes to Texas and Ga., abundant. A large, coarse fish of the larger streams and lakes, not much valued as food,

except in S. (Lat., grunting, the fish making considerable sound by grinding its large pharyngeals.)

335. EQUETUS Rafinesque (Lat., *eques*, horseman)

576. **E. acuminatus** (Bloch & Schneider). Ribbon Fish. Young light in color, with about 7 longitudinal dark bands, which become wider than the interspaces in the adult. Anterior profile very steep but not vertical. Dorsal spines little elevated. D. X–I, 38 to 40. N. C. to Brazil. (*Eques* Bloch, a name given earlier by Linnaeus to a section of Papilio.) (Lat., acuminate.)

Family CX. GERRIDAE (The Mojarras)

Body compressed, with large, smooth scales; lateral line continuous; mouth small, the premaxillary excessively protractile, the spines of the premaxillaries extending backward in a deep groove on top of head; maxillary simple, not sheathed by the narrow preorbital; mandible scaly, with a slit behind it, to permit motion; teeth small, in jaws only; preopercle entire or serrate; pseudobranchiae concealed; gills normal; gill membranes separate; lower pharyngeal bones close together, usually loosely united; D. single, with 9 spines; A. with 3 or 2; V. I, 5; air bladder present. Vertebrae 24. Oviparous, carnivorous. Found along shores of most warm seas. Silvery fishes, of moderate size.

a. Second interhaemal spine greatly enlarged as a hollow cylinder receiving the pointed end of the large air bladder. Preorbital and preopercles entire; body not elevated; premaxillary groove small. . . . . Eucinostomus, 336.

336. EUCINOSTOMUS Baird

(Gr., *εὖ*, well; *κινέω*, to move; *στόμα*, mouth, the mouth being very protractile.)

577. **E. gula** (Cuvier & Valenciennes). Silver Jenny. Mojarra de Ley. Mojarra. Body oblong, little elevated, the fins relatively low. Silvery, faintly barred; 3d D. spine not half head; 2d A. spine short. Head $3\frac{1}{3}$; depth $2\frac{1}{3}$. D. IX, 10. A. III, 8. Scales 5–43–10. L. 5. W. I. to N. C., common S., the young N. to Woods Hole. One of the smallest of the family, used as bait. (Lat., throat, the fish being called "Petite Gueule" in Martinique.)

578. **E. pseudogula** Poey. Body more slender than in *gula*, and the premaxillary groove not crossed by scales in front; A. III, 7. Tropical America, N. to N. C. (Gr., *ψεῦδης*, false; *gula*.)

Suborder SQUAMIPENNES

Vertical fins closely scaled; 1st temporal and pharyngeals progressively modified, as if transitional from perch-like forms to *Balistes*. (Lat., scale-fins.)

Family CXI. EPHIPPIDAE (The Spadefishes)

Body compressed and elevated; scales ctenoid, densely covering the body and the soft parts of the vertical fins; lateral line present. Mouth small, terminal, with bands of fine (but hardly brush-like) teeth; premaxillary protractile; maxillary simple, partly slipping under preorbital; gill membranes broadly attached to the isthmus; gill rakers very short; pseudobranchiae present. Dorsal deeply notched, with 8 to 11 spines, the soft part very high, as is also the soft anal; A. spines 3 or 4; C. subtruncate; P. short; V. normal. Air bladder large. Species few, large, chiefly inhabiting the warm seas.

a. Anal spines 3; dorsal spines 8 or 9, the 3d elevated; profile very steep; scales small. Chaetodipterus, 337.

337. CHAETODIPTERUS Lacépède (Gr., *χαίτοδον*, Chaetodon; *δίς*, two; *πτερόν*, fin)

579. **C. faber** (Broussonet). Spadefish. False Angel Fish. Grayish, the young with 4 to 7 black cross-bands; soft lobe of vertical fins becoming falcate with age. Head 3; depth 1¼. D. VIII–I, 20. A. III, 18. Lat. l. 60. L. 24. Warm seas, N. to Cape Cod; a good food fish. (An old name, meaning blacksmith.)

Family CXII. CHAETODONTIDAE (The Butterfly Fishes)

Body much compressed, nearly orbicular, covered with moderate or small scales, more or less ciliated; lateral line present; mouth small, protractile, terminal, with brush-like teeth, in jaws only; gill membranes attached to isthmus; gill rakers small; dorsal continuous, its soft rays densely scaly. A large family of the coral seas; carnivorous, especially noted for their brilliant colors and excessive vivacity. Our species are casual waifs that stray from the Gulf Stream.

a. Preopercle unarmed; median dorsal spines longest. (*Chaetodontinae.*)
b. Snout not produced in a long beak; scales moderate; color mainly yellow. Chaetodon, 338.
aa. Preopercle with a very long spine at its angle. (*Pomacanthinae.*)
c. Interopercle unarmed; scales small; color dusky. . . . . Pomacanthus, 339.

338. CHAETODON (Artedi) Linnaeus (Butterfly Fishes) (Gr., *χαίτοδον*, Chaetodon)

580. **C. ocellatus** Bloch. Parché. Isabelita de lo Alto. Scales in series running upward and backward above, horizontally below. Grayish yellow; black ocular band across eye to cheek; a large black spot, not ocellated, on dorsal, a dusky shade below it. Head 3; depth 1½. D. XIII, 20; A. III,

16. Scales 6–34–15. W. I., common; in Gulf Stream, to R. I. (*C. bimaculatus* Bloch.) (Lat., eyed.)

581. **C. striatus** Linnaeus. Butterfly Fish. Differs from *capistratus* in lacking the ocelli and in being marked with dark cross-bands. W. I. to Brazil, rare N. to Delaware Bay (Lat., striped.)

582. **C. capistratus** Linnaeus. Butterfly Fish. Scales marked each by a black streak, running in series downward and forward above and downward and backward below, thus meeting at an angle on axis of body. Body with a large black ocellus below soft D. Head $3\frac{1}{4}$; depth $1\frac{2}{3}$. D. XIII, 19; A. III, 17; scales 6–42–17. W. I., rather rare N. to Woods Hole. (Lat., bridled.)

339. POMACANTHUS Lacépède

583. **P. arcuatus** Linnaeus. Black Angel. Portugais. Gray, scale centers black; young barred. Caudal truncate or lunate. Head $3\frac{1}{3}$; depth $1\frac{1}{3}$; D. IX, 31; A. III, 24; scales 8–53–7, small scales around the large ones. W. I., N. in Gulf Stream to N. Y. (Lat., arched, from the crossbars.)

Order XXVIII. PHARYNGOGNATHI

This order includes forms allied to the *Labridae*, and distinguished especially by the complete union of the lower pharyngeal bones. All of these have the gills reduced, $3\frac{1}{2}$ in number; the last gill slit wanting or nearly so. The *Pharyngognathi* being chiefly tropical are scantily represented within our limits; the order shows great variety within itself.

Family CXIII. LABRIDAE (The Wrasses)

Body oblong, covered with cycloid scales; lateral line interrupted or angularly bent. Mouth terminal, protractile; the teeth of the jaws generally strong; no teeth on vomer or palatines; maxillary simple, slipping under membranous edge of preorbital; lower pharyngeals solidly united, with blunt teeth; D. continuous, with 8 to 20 spines, the number greatest in northern forms, which as usual among fishes, have also an increased number of vertebrae; anal spines 2 to 6, usually 3. V. normal. Pseudobranchiae present. Gills $3\frac{1}{2}$, no slit behind the last; nostrils double; air bladder present. Species chiefly of the tropical seas, where most of them are brilliantly colored and some are valued as food. The teeth are adapted for the crushing of shells.

a. Vertebrae in increased number, 30 to 38; dorsal spines 16 to 20; teeth in jaws distinct, the anterior canine; no posterior canines; lateral line continuous; lips thick. (*Labrinae.*)
b. Preopercle serrate; cheeks and opercles scaly; teeth in more than two series, the outer enlarged. . . . . Tautogolabrus, 340.
bb. Preopercle entire; cheeks scaly; opercles naked; teeth in about two series. Tautoga, 341.

340. TAUTOGOLABRUS Günther (*Tautoga* + *Labrus*)

584. **T. adspersus** (Walbaum). Cunner. Chogset. Bergall. Blue Perch. Brownish blue, with brassy shades; young with a black dorsal spot. Interopercle naked; snout not very sharp. Head 3½; depth 3. D. XVIII, 10. A. III, 9. Lat. l. 45. L. 10. Newfoundland to Va., common N. about rocks. (Lat., speckled.)

341. TAUTOGA Cuvier & Valenciennes (*Tautog*, Indian name)

585. **T. onitis** (Linnaeus). Tautog. Oyster Fish. Blackfish. Blackish; young greenish, irregularly barred. Head 3¼; depth 3. D. XVI, 10. A. III, 8. Lat. l. 60. L. of largest, 3 feet. Maine to S. C., a common food fish especially N. (Gr., *ὀνίτις*, a kind of plant, allusion unknown.)

Note. A number of additional species of *Labridae* as well as *Pomacentridae* (the Demoiselles) and *Scaridae* (the Parrot-fishes, having the teeth united into a beak), range N. along our coast for a varying distance — as waifs from the Tropics.

Order XXIX. CATAPHRACTI[1] (The Mail-cheeked Fishes)

We next pass to the group of *Cataphracti*, an assemblage of families, characterized as a whole by the development of a "suborbital stay," a bony process extending from the suborbital ring backward across the cheeks to or towards the preopercle. In the extreme forms (*Agonidae*, *Triglidae*, etc.) the cheek is wholly mailed. In others, as *Cyclopteridae* and *Liparidae*, this stay is hidden under soft skin. The *Cataphracti* have the 3d upper pharyngeal large, and basin-shaped. They differ much among themselves, the *Scorpaenidae* resembling Perciform fishes, while some of the others are widely aberrant.

Family CXIV. SCORPAENIDAE (Scorpion Fishes and Rock Cod)

Body oblong, robust, usually covered with ctenoid scales; lateral line present. Head large, with spinous ridges above; opercle with 2 spinous processes; preopercle with 5. Mouth large, the jaws with villiform teeth; premaxillaries protractile; maxillary broad, simple, not sheathed by preorbital; bony suborbital stay present, mostly covered by skin and usually not reaching preopercle. Gill membranes free and separate. Gills 3½, with no slit behind the last. V. normal, I, 5. D. continuous, with 8 to 16 strong spines, those in tropical seas often envenomed. Arctic species have more spines and more vertebrae than tropical species. Vertebrae 24 to 32; A. short, with 3 spines; P. broad. Pseudobranchiae and air bladder large. Species numerous, carnivorous fishes living about rocks in most seas, often at consider-

[1] Also called *Loricati*, *Scleroparei*, and *Pareiopliitae*, all these names having reference to the suborbital stay.

able depths, especially abundant about Cal. and Japan. Non-migratory; usually brown or red in color; valued as food, the flesh coarse in texture. Most are viviparous, the young ¼ inch long when born. (Gr., *σκορπαίνα*, an ancient name from *σκορπίος*, scorpion.)

a. Dorsal spines 15; vertebrae 12 + 19 = 31; palatine teeth present; head not very rough above. . . . . SEBASTES, 342.

342. SEBASTES Cuvier (Gr., *σεβαστός*, magnificent)

586. **S. marinus** (Linnaeus). ROSEFISH. HEMDURGAN. NORWAY HADDOCK. Body ovate; top and sides of head evenly scaled; cranial ridges low and sharp; preocular, supraocular, postocular, tympanic, and occipital ridges present; eye very large; chin prominent. Bright red, somewhat dusky on opercle. Head 3; depth 2⅖. D. XV, 14. A. III, 8. Lat. l. 40, its tubes 85. N. Atl., S. to N. J.; common N. (*Eu.*) (Lat., marine.)

NOTE. A few other species of *Scorpaenidae* occur on our coast, as wanderers from the Tropics, or as inhabitants of rather deep water.

FAMILY CXV. COTTIDAE (THE SCULPINS)

Body elongate, more or less, the head usually large and depressed; eyes high; bony stay conspicuous, but not covering the cheek; preopercle armed; teeth in villiform bands; maxillary simple; gills 3½ or 4; gill membranes connected, often joined to isthmus. Body naked, or irregularly scaled or warty, never evenly scaled; lateral line present. Dorsals usually separate, the spines slender, never envenomed. A. without spines; P. large, with broad procurrent base, the lower rays simple; V. thoracic, usually I, 3 or I, 4 rarely I, 5, sometimes wanting, never united. Pseudobranchiae present. Vertebrae, as usual in northern fishes, numerous, 35 to 50. Fishes mostly of the springs, rock pools, and seashores of Arctic and Subarctic regions; a few in the deep sea, most numerous in the North Pacific. Singular fishes, mostly of small size, and of little value as food, the flesh of coarse texture. The fresh-water species are very destructive to eggs of other fishes.

a. Dorsal spines not concealed; gill openings not very small; V. present, I, 3 or I, 4. (*Cottinae.*)
  b. Vomer with teeth.
    c. Slit behind last gill obsolete or reduced to a round pore; skin without true scales.
      d. Species of fresh water; gill membranes broadly united to the isthmus, not forming a fold across it; head feebly armed; palatine teeth few or none; skin naked or with small prickles. . . . . COTTUS, 343.
      dd. Species marine; gill membranes free from isthmus or else forming a broad fold across it; head well armed.
        e. Palatine teeth none; skin naked or with irregular rough plates; shore species of large size. . . . . MYOXOCEPHALUS, 344.
        ee. Palatine teeth well developed; skin smooth; small species of deep waters, N. ARTEDIELLUS, 346.
    cc. Slit behind last gill small, but evident; no palatine teeth.

f. Skin smooth; gill membranes not quite free from isthmus; preorbital, etc., strongly cavernous; depths of the Great Lakes and Arctic seas. . . . TRIGLOPSIS, 347.

ff. Skin with minute prickly scales, and with rough plates along back and lateral line; gill membranes free from isthmus; bones not cavernous; northern seas. TRIGLOPS, 348.

bb. Vomer without teeth; preopercular spine antler-like; a fold across isthmus; no slit behind last gill; no scales; marine species. . . . . GYMNOCANTHUS, 349.

343. COTTUS (Artedi) Linnaeus (Ancient name of the European *Cottus, C. gobio*, from Gr., κόττος, head)

a. Preopercular spine large, as long as eye, strongly hooked upward and slightly spiral; skin smooth or with coarse prickles. (*Tauridea* Jordan & Rice.)

587. **C. ricei** (Nelson). Head broad, body contracted at base of tail. Olivaceous, finely speckled. Head $\frac{3}{5}$; depth $5\frac{1}{5}$. D. VIII–17. A. 12. L. $2\frac{1}{2}$. Hudson Bay to Great Lakes, rare, and only in deep water S. (*C. pollicaris* Jordan & Gilbert.) (For F. L. Rice, its discoverer.)

aa. Preopercular spine small, turned upwards, mostly covered by the skin; skin smooth or with fine prickles.

b. Ventral rays typically I, 4, the spine obscure; palatine teeth present; anal rays usually 12 to 14.

588. **C. bairdii** Girard. BLOB. MUFFLEJAWS. MUDDLER. MILLER'S-THUMB. Body rather stout, the head very broad; preopercular spine, short and straightish, turned upwards; palatine teeth present. Olivaceous, much barred and speckled. Head $3\frac{1}{3}$; depth 4 to 6. V. I, 4. D. VI to VIII–12. L. 3 to 7 inches. One of the largest species of this very variable genus. S. Canada to Ga. and Mo., in small clear streams and springs. (? *Pegedictis ictalops* [1] Rafinesque; *Cottus richardsoni* Agassiz, not *Trachidermis richardsoni* Heckel, also a *Cottus; Cottus bairdii* and *meridionalis* Girard.) The typical subspecies **C. b. bairdii** occurs in small lakes and in streams from S. Canada to Ohio Valley. Represented in Lakes Superior, Huron, Michigan, Ontario, and Cayuga by subspecies **kumlieni** (Hoy): more slender than the preceding and less sharply colored, and trunk longer (vent nearer middle of C. than tip of snout). Represented in Tenn. and Ozark upland regions by **C. b. zopherus**: head large; color dark; cross bands black; size small — perhaps not valid. (To Spencer Fullerton Baird.)

bb. Ventral rays typically 1, 3.; palatine teeth wanting; skin more slimy (*Uranidea* DeKay).

589. **C. cognatus** Richardson. EASTERN MILLER'S-THUMB. Body rather slender, the fins large. Olivaceous, much mottled, the colors variable but the black bars less distinct; first dorsal often edged with red. Head $3\frac{1}{3}$; depth 5. D. VI to VIII–16 to 18. A. 11 to 14. Alaska and Great Lakes to New England and W. Va. L. 4. (*Cottus gracilis, viscosus, franklini, formosus*, and *hoyi* of authors, according to the studies of Hubbs, whom I follow, with some

[1] Rafinesque's *Pegedictis ictalops*, the "Cat's-eye Springfish," must have been intended for a *Cottus*, although he ascribes to it small scales. It was apparently described from memory, and is discarded by several authors. This is not unnatural, there being none at all. Gill regarded this account as referring to *Catonotus flabellaris*.

hesitation, in reducing most of our Eastern species of *Cottus* to 3 instead of 13. (Lat., related.)

344. MYOXOCEPHALUS Tilesius (Sea Sculpins)

(Gr., *μυοξός*, the dormouse; *κεφαλή*, head)

a. Top of head covered with thin smooth skin; Atlantic species. (*Acanthocottus* Girard.)
b. Anal fin short, with 10 rays.

590. **M. aeneus** (Mitchill). Grubby. Little Sculpin. Upper preopercular spine shorter than eye, nearly twice length of next. Grayish brown, much variegated with blackish; no large white spots. Head $2\frac{3}{4}$; depth 4. D. IX–13. A. 10. V. I, 3. L. 6. Gulf of St. Lawrence to N. J., common. **M. mitchilli** Cuvier and Valenciennes, another small Sculpin of the North Atlantic coast, is regarded as a distinct species by some recent observers. (Lat., brassy.)

bb. Anal fin long, of 14 rays.
c. Upper preopercular spine about as long as eye, reaching middle of opercular spine, not twice length of the spine below it.

591. **M. scorpius** Linnaeus. Daddy Sculpin. Shorthorn Sculpin. Dark brown, with darker bars; belly in ♂ dusky, with round black spots; fins spotted and barred; top of head with spinous tubercles; eye large. Head $2\frac{1}{2}$; depth $4\frac{1}{2}$. D. X–17. A. 14. V. 1, 3. Greenland, S. to N. Y., common N. (*Eu.*) The American form, larger, but scarcely different otherwise, has been called Subsp. **groenlandicus** C. & V. (Gr., *σκορπίος*, scorpion.)

cc. Upper preopercular spine very long, longer than eye, reaching beyond tip of opercular spine, its length more than 4 times that of the spine below it.

592. **M. octodecimspinosus** (Mitchill). Longhorn Sculpin. Hackle-head. Body slender, with long, narrow head; a strong spine above eye; top of head with ridges; eye very large. Olivaceous, with dark bars; fins mottled. Head $2\frac{1}{3}$; depth $5\frac{1}{2}$. D. IX–15. A. 14. V–I, 3. L. 15. Labrador, S. to N. J. (Lat., *octodecim*, eighteen; *spinosus*, spined.)

345. ICELUS Kröyer (Gr., *Ἴκελος*, son of *ὕπνος*, god of sleep)

593. **I. bicornis** (Rheinhardt). Preopercular spines 34, the upper hooked; 2 pairs of spines on occiput, a pit between. Yellowish, mottled. Head 3; depth 5. D. IX–19. A. 14. L. 6. Circumpolar, S. to Cape Cod. (*Eu.*) (Lat., two-horned.)

346. ARTEDIELLUS Jordan (Diminutive of *Artedius*, a related genus, named for Petrus Artedi, "Father of Ichthyology")

594. **A. uncinatus** (Kröyer). Eye very large; upper spine of preopercle large, hooked upward. Olivaceous, mottled and barred. Head 3; depth $4\frac{1}{2}$.

D. VIII–13. A. 11. L. 4. North Atlantic, S. to Cape Cod, in deep water. (Lat., *hooked.*)

347. TRIGLOPSIS Girard (Gr., *τρίγλα*, Trigla; *ὄψις*, appearance)

595. **T. thompsonii** Girard. Body very slender; head long, depressed; mouth long; eye very large, 4 in head; skull extremely cavernous; preopercle with 4 short, sharp spines; soft D. and A., very high; lat. l. chain-like. Olivaceous, with faint dark blotches. Head 3; depth 6; D. VIII–18. A. 15. V. I, 3. L. 3. Soft dorsal 3 times as high as first; lateral line distinguishable to 8th soft ray of dorsal. Deep waters of Great Lakes (Lake Michigan). (To Zadock Thompson.)

Two other species of this rare relic of a marine group in the Great Lakes are regarded by Hubbs as not distinguishable. These are **Triglopsis stimpsoni** Hoy, from Lake Michigan, and **Triglopsis ontariensis** Jordan and Thompson (W. F.), from Lake Ontario.

348. TRIGLOPS Reinhardt (Gr., *τρίγλα*, Trigla; *ὤψ*, appearance)

596. **T. ommatistius** Gilbert. Head slender; eye large; tail very slender; preopercular spines small, simple; sides with more than 45 irregular plate-like folds below the prickly back. Olivaceous, variegated and spotted with dark; a black ocellus on spinous D. of male. Head $3\frac{1}{2}$; depth about $5\frac{1}{2}$. D. X or XI–21 or 22. A. 20 or 21. L. 5. Gulf of Maine. (Gr., *ὄμμα*, eye; *ἱστίον*, sail.)

597. **T. terraenovae** Gilbert. Sides with about 26 regular folds. D. X or XI–21 to 23. A. 20 to 22. Newfoundland and S. Labrador. (Lat., of the new land, — Newfoundland.)

349. GYMNOCANTHUS Swainson (Gr., *γυμνός*, naked; *ἄκανθα*, spine)

598. **G. tricuspis** (Reinhardt). Staghorn Sculpin. Eye very large; skin mostly smooth; preopercular spine broad, shorter than eye, with 3 points; V. very long. Dark brown with darker bars; axil dusky in ♂, with round white spots. Head $3\frac{1}{3}$; depth $4\frac{2}{3}$. D. XII–16. A. 18. V. I, 3. L. 12. Arctic, S. to Me. (*Eu.*) (Lat., *tris*, three; *cuspis*, cusp.)

Family CXVI. HEMITRIPTERIDAE (The Sea Ravens)

Similar to the *Cottidae* but with the spinous dorsal much longer than the soft part, of 14 to 16 spines, its outline deeply notched, head large, with many humps, ridges, and depressions; skin with prickles and warts; no scales; teeth on vomer and palatines. Species few, in N. Atl. and N. Pac.

a. Dorsal spines 16 to 18. . . . . Hemitripterus, 350.

350. HEMITRIPTERUS Cuvier (Irish Lords) (Gr., ἡμι, half; τρίς, three; πτερόν, fin)

599. **H. americanus** (Gmelin). Sea Raven. King of Norway. Head large, with many irregularities and fleshy slips. Brown, body and fins much variegated with black. Head $2\frac{2}{3}$; depth $3\frac{3}{4}$. D. IV, XII–I, 12. A. 13. Lat. l. 40. L. 2 feet. N. Atlantic coast of America, from Labrador to Chesapeake Bay, common N. A singular fish.

Family CXVII. AGONIDAE (The Alligator Fishes)

Fishes allied to the *Cottidae* and similar in general structure, but with the body completely covered by a coat of mail, composed of about 8 series of large bony plates; head entirely bony externally; suborbital stay covering the cheek; gills $3\frac{1}{2}$, no slit behind the last, pseudobranchiae large. Vertebrae (as in other Arctic fishes) numerous, 35 to 40. Spinous dorsal sometimes wanting. Small fishes of the Arctic seas; most abundant in N. Pacific.

a. Spinous dorsal wanting; gill membranes free from isthmus. (*Aspidophoroidinae*.)
b. Bony plates keeled, without spines; fins very small. . . . . Aspidophoroides, 351.

351. ASPIDOPHOROIDES Lacépède (Gr., ἀσπίς, shield; φορέω, to bear; εἶδος, form, — resembling *Aspidophorus*)

600. **A. monopterygius** (Bloch). Body elongate, subterete, resembling that of a pipe-fish; teeth on vomer; snout with 2 diverging spines above; no other spines on head; eyes very large. Brownish, obscurely barred. Head $5\frac{2}{3}$; depth 9. D. 5. A. 6. Lat. l. 50. L. 6. Greenland to N. J. (Gr., μόνος, single; πτέρυξ, fin.)

Family CXVIII. DACTYLOPTERIDAE (The Flying Gurnards)

Body elongate, with bony keeled scales; head blunt, cuboid, its surface almost entirely bony; nuchal shield with a strong spine on each side; preopercle with a very long rough spine; opercle small; isthmus very broad, scaly; gill rakers minute; mouth small, with granular teeth in jaws only; tail with 2 serrate, knife-like appendages. Spinous D. short, its first spines free; an immovable spine between dorsals; C. small, lunate; P. divided to base, the anterior part composed of about 6 rays connected by membrane; the posterior part very long (reaching C. in adult), the rays slender and simple; V. close together, I, 4. Air bladder complex; vertebrae 9 + 13 = 32. A few species in the warm seas, able to flutter for short distances in the air.

352. DACTYLOPTERUS (*Cephalacanthus* Lacépède, the young) (Gr., *δάκτυλος*, finger; *πτερόν*, wing)

601. **D. volitans** (Linnaeus). Flying Gurnard. Sea Robin. Greenish and brown, mottled with orange or red, the belly usually orange; P. with blue streaks and spots; C. with reddish bars. Color very variable. Head $4\frac{1}{3}$; depth $5\frac{1}{2}$. D. II, IV–8. A. 6. P. 28–6. L. 12. Atlantic, N. to Newf'd. (*Eu.*) (Lat., flying.)

Family CXIX. TRIGLIDAE (The Gurnards)

Body subfusiform, covered with rough scales, rarely naked; head entirely covered with rough bones, most of them usually armed with spines; mouth moderate, with small teeth or none; maxillary simple; gills 4, a slit behind 4th; pseudobranchiae present; V. I, 5, wide apart, separated by a flat area. Spinous D. short; A. without spines; C. narrow. P. large, with broad base, the 3 lowermost rays detached from the rest and from one another. Air bladder present. Vertebrae about 24, as in nearly all tropical fishes. Species rather numerous, in all warm seas. (Gr., *τρίγλα*, old name of *Mullus*, the Surmullet.)

a. Body scaly; teeth present on jaws, vomer and palatines; 3 free P. rays. Prionotus, 353.

353. PRIONOTUS Lacépède. (Sea Robins) (Gr., *πρίων*, saw; *νῶτος*, back)

a. Mouth rather small, the maxillary not $\frac{1}{3}$ head; a cross groove on top of head behind eye; a black ocellated spot on spinous D. (*Merulinus* Jordan & Evermann.)

602. **P. carolinus** (Linnaeus). Body rather stout; preopercular spine with no smaller one before it; P. short, not half body; P. appendages broadened at tip; gill rakers about 10; bones of head comparatively smooth. Olive, back with 4 dark cross-shades; pale oblique streaks on 1st D. Head 3; depth 5. D. X–13. A. 12. Lat. l. 58 (pores). L. 12. Bay of Fundy to S. C.

603. **P. scitulus** Jordan. Related to *carolinus*, but more slender (depth 6 instead of 5); interorbital more deeply concave and only $\frac{2}{3}$ as wide as eye. Head bones very smooth, the striations very weak, the spines not depressed. Body covered with rounded bronze spots. N. C. to Fla. (Lat., slender.)

aa. Mouth rather large; the maxillary about $2\frac{1}{2}$ in head; no cross-groove on top of head; black spot on 1st D. diffuse; preopercular spine with a smaller one before it. (*Prionotus.*)

b. Cheek bone without distinct spine at center of radiation; edge of preorbital granular-serrate; spines on top of head not knife-like.

604. **P. strigatus** Cuvier & Valenciennes. Head not very broad; gill rakers long, 15 to 20; interorbital area flattish. Brownish, side with a distinct bronze band parallel with lateral line, this breaking up in spots behind; head spotted;

body and fins with dark clouds; P. finely barred. Head $2\frac{3}{4}$; depth 4. D. X–12. A. 11. Scales 10–60–23. P. 2 in body. L. 12. Mass. Bay to Va. (Lat., striped.)

605. **P. evolans** (Linnaeus). Similar to *strigatus*, but with the pectoral not barred, all the rays plain blackish; the scales larger (30 instead of 34 between last D. spine and vent); the interorbital a little narrower and more concave; the first dorsal spine scarcely granulated. N. C. to Fla. (Lat., flying.)

bb. Cheek bone with a spine at center of radiation; bones of head sharply striate; head broad, the spines above compressed and knife-like, especially in young. (*Ornichthys* Swainson.)

606. **P. tribulus** Cuvier & Valenciennes. Spines much larger than in others, still larger in young; spines on snout and side of cheek in line with preocular spine; gill rakers thickish, about 10. Brownish, much clouded; no lengthwise stripe. Head $2\frac{1}{3}$; depth $4\frac{1}{3}$; D. X–12. A. 11. Lat. l. 50. L. 12. P. 2 in body. Texas to N. C., and possibly N. Y.; chiefly S. (Lat., a thistle, or other source of tribulation.)

Family CXX. LIPARIDAE (The Sea Snails)

Body oblong, covered with lax, naked skin; head broad, obtuse; suborbital stay slender, concealed; teeth small, mostly tricuspid; opercles unarmed; gill openings small, the membranes joined to the isthmus; gills $3\frac{1}{2}$, no slit behind last; no air bladder; pseudobranchiae rudimentary. D. continuous, the spines feeble. A. without spines. V. I, 5, fully united, forming the bony center of a broad sucking-disk, sometimes wanting. P. broad, the base procurrent, the lower rays longer than those above them. Vertebrae 40 to 45. Small fishes of the Arctic seas, most of them in deep water, most abundant in N. Pac. Although very different in appearance, they are closely related to some of the *Cottidae*.

a. Ventral disk present. (*Liparinae.*)
  b. Ventral disk well developed; vent well behind head; dorsal and anal joined to caudal.
    c. Dorsal fin divided nearly to base, the spinous portion apparent though covered by thick skin; a notch at base of caudal. . . . . Neoliparis, 354.
    cc. Dorsal fin continuous, not divided, fully joined to the caudal. . . . Liparis, 355.

354. NEOLIPARIS Steindachner (Gr., *νεός*, new + *Liparis*)

607. **N. atlanticus** Jordan & Evermann. Snout broad, disk $1\frac{3}{4}$ in head. Yellowish, with pale dots everywhere; fins dark-edged, first dorsal spine as high as head. D. VI, 25. A. 23. P. 30. C. 14. L. 3. Conn. to Newfoundland, not rare. (Near the European species, *N. montagui*.) (Lat., of the Atlantic.)

355. LIPARIS (Artedi) Scopoli (Gr., λιπαρός, sleek)

608. **L. liparis** (Linnaeus). Sea Snail. Body thick. Yellowish, with purplish stripes. Disk 2 in head. Head 4; depth 3½. D. 33. A. 28. P. 34. L. 5. N. Atlantic, S. to Va. (*Eu.*)

Family CXXI. CYCLOPTERIDAE (The Lumpsuckers)

Closely related to the *Liparidae*, but with the body short and thick, covered with thick skin, which is often tubercular or spinous. Vertebrae fewer, about 28. Adhesive ventral disk well developed, enabling the fishes to fasten themselves firmly to rocks. Species few, in Arctic seas.

a. Spinous dorsal present; skin with bony plates and tubercles.
b. Dorsal spines not disappearing with age; gill opening a small slit on level of eye; sucking disk large, size small. . . . . Eumicrotremus, 356.
bb. Dorsal spines in adult enveloped in a fleshy hump; gill openings larger; disk small, size large. . . . . Cyclopterus, 357.

356. EUMICROTREMUS Gill (Gr., εὖ, well; μικρός, small; τρῆμα, aperture)

609. **E. spinosus** (Müller). Shields with small tubercles and slender flexible prickles. Olivaceous, the naked skin punctate gill; opening very small. Head 3; depth 2. D. VII–11. A. 10. Mass., N. (*Eu.*) (Lat., spined.)

357. CYCLOPTERUS (Artedi) Linnaeus (Gr., κύκλος, circle; πτερόν, fin)

610. **C. lumpus** Linnaeus. Lumpsucker. Lumpfish. Shields without spines. Olivaceous, punctulate; young black, with green specks. Head 3¾; depth 2. D. VII–10. A. 10. L. 15. (*Eu.*) Arctic, S. to Chesapeake Bay. (Eng., lump.)

Order XXX. DISCOCEPHALI (The Sucking Fishes)

A small group, characterized by a singular modification of the spinous dorsal fin with which the animal attaches itself to larger fishes or to boats, logs, or other objects in the sea, being thus carried for long distances. (Gr., δίσκος, disk; κεφαλή, head.)

Family CXXII. ECHENEIDAE (The Remoras)

Body fusiform, elongate, with minute, smooth scales; mouth wide, with villiform teeth; lower jaw projecting. Spinous dorsal modified to form into a sucking disk on top of head and composed of a double series of transverse movable cartilaginous plates. Opercles unarmed, P. placed high. V. I, 5. D.

and A. long, similar; gill rakers short; no pseudobranchiae; no air bladder. Vertebrae more than 24. Species few, inhabiting the open seas, attaching themselves to sharks, swordfishes, tunnies, barracudas, turtles, and to floating objects.

a. Body slender; vertebrae 14 + 16 = 30; disk of 21 to 25 laminae; its length not more than ⅓ body. . . . . ECHENEIS, 358.
aa. Body robust; vertebrae 12 + 15 = 27; disk more than ⅓ body, of 16 to 18 laminae.
b. Pectoral rays normal, soft.
c. Disk longer than soft dorsal fin, of 18 laminae. . . . . REMORA, 359.
cc. Disk shorter than soft dorsal fin, of 16 laminae. . . . . REMOROPSIS, 360.
bb. Pectoral rays stiff, broad, ossified. . . . . RHOMBOCHIRUS, 361.

358. ECHENEIS (Artedi) Linnaeus (Gr., *ἐχενηίς*, an ancient name, meaning one who holds ships back)

611. **E. naucrates** Linnaeus. SHARK PILOT. SUCKING FISH. PEGADOR. Blackish, belly dark; a black lateral stripe; corners of C. pale. Form relatively elongate. Head 5½; disk 3⅔, shorter than soft D.; width between P. 7½. D. XXII–36. A. 35 to 38. L. 30. Warm seas, N. to Cape Cod. The largest and commonest species, on sharks, etc., dropping off at once if its host is captured. (*Eu.*) (Gr., *ναυκράτης*, pilot.)

612. **E. naucratoides.** (Zuieuw.) Disk longer, with fewer laminae. D. XXI–35. A. 33. West Indies, N. to Cape Cod. (*naucrates* + Gr., *εἶδος*, like.)

359. REMORA Forster (Latin name, one who holds back)

613. **R. remora** (Linnaeus). REMORA. SUCKING FISH. Body relatively robust. Uniform dusky; head 4; disk 2¾, longer than soft D.; width between P. 5¼. D. XVIII–23. A. 25. L. 12. Warm seas, N. to Mass.; not rare. Holding closely to its host even if the latter is taken.

360. REMOROPSIS Gill (*Remora* + Gr., *ὄψις*, appearance)

614. **R. brachyptera** (Lowe). SWORDFISH REMORA. Light brown. Head 4; disk shorter than dorsal; width between P. 6½. D. XVI–30. A. 26. Warm seas, rarely N. On swordfish. (Gr., *βραχύς*, short; *πτερόν*, fin.)

361. RHOMBOCHIRUS Gill (Gr., *ῥόμβος*, rhomb; *χείρ*, hand)

615. **R. osteochir** (Cuvier). SPEARFISH REMORA. Light brown; mouth small; disk very large. P. broad and stiff. Head 5; disk 2¼; width, between P., 5. D. XVIII–21. A. 20. W. I., rare N. On spearfish. (Gr., *ὀστέον*, bone; *χείρ*, hand.)

Order XXXI. GOBIOIDEA (The Gobies)

Family CXXIII. ELEOTRIDAE (The Gobies)

Ventral fins separate from one another.

a. Ventral rays I, 5; isthmus broad; scales large, ctenoid. . . . . Dormitator, 362.
aa. Ventral rays I, 4; isthmus narrow; scales very small, mostly cycloid. Ioglossus, 363.

362. DORMITATOR Gill (Lat., a sleeper)

Vomer toothless; isthmus broad; head and body well scaled; scales large, ctenoid.

616. **D. maculatus** (Bloch). Body stout (depth about 3); head short and broad. Scales 33–12. D. VII–I, 8 or 9; A. I. 9 or 10. Dark gray or brown, with lighter spots; a large black spot above base of pectoral. N. C. to W. I. (Lat., spotted.)

363. IOGLOSSUS Bean (Gr., *ἰος*, arrow; *γλῶσσα*, tongue)

617. **I. calliurus** Bean. Body elongate, strongly compressed. Mouth large, oblique; lower jaw projecting; teeth in part canine; none on vomer. Light olive, everywhere punctulate; dorsals edged with black. L. 4½. N. C. to Gulf of Mexico. (Gr., *κάλλος*, beauty; *οὐρά*, tail.)

Family CXXIV. GOBIIDAE (The Gobies)

Body oblong or elongate, variously naked or scaly; no lateral line; mouth and teeth various; canines, when present, small; premaxillary protractile; suborbital without bony stay; opercles mostly unarmed; pseudobranchiae present; gills 4; gill membranes united with the isthmus; spinous dorsal little developed, of 2 to 8 flexible spines; anal without spines; V. I, 5, close together and more or less fully united into a sort of sucking disk; C. convex; anal papilla evident. No pyloric caeca nor air bladder. Vertebrae about 25. Carnivorous fishes, mostly small, creeping about on sandy bottoms in rivers and along shores after the fashion of the Darters, a group which the Gobies superficially resemble. Upwards of 500 species known; chiefly of tropical estuaries and ponds. South of Cape Hatteras multitudes are found on sandy bottoms, but none are common N. of that point.

a. Ventral fins united; dorsals separate, free from caudal.
  b. Ventral disk not adnate to belly; teeth simple. (*Gobiinae.*)
    c. Body with ctenoid scales; dorsal spines 6; pectoral with its upper rays slender and silk-like, not like the others; tongue emarginate. . . . . Bathygobius, 364.
    cc. Body with ctenoid scales; dorsal spines 6; pectoral with the rays all similar, none silk-like; tongue emarginate. . . . . Ctenogobius, 365.
    ccc. Body with small, cycloid scales; dorsal spines 7 or 8; pectoral with the rays all similar, none silk-like. . . . . Microgobius, 366.
    cccc. Body entirely scaleless except along lower part of caudal peduncle; dorsal spines 6. Evermannichthys, 367.
    ccccc. Body entirely scaleless; dorsal spines 7. . . . . Gobiosoma, 368.

364. BATHYGOBIUS Bleeker (*Mapo* Smitt)
(Gr., *βαθύς*, low + *Gobius*, a genus of fishes)

618. **B. soporator** (Cuvier & Valenciennes). Mapo. Olivaceous, dotted. C. short. Head 3; depth 4⅔. D. VI–1, 9. A. 8. Scales 35–13. L. 6. W. I., N. to Va. in shallow waters. This genus differs from *Gobius* in the emarginate tongue; silk-like pectoral rays occur also in *Gobius*. (Lat., sleeper.)

365. CTENOGOBIUS Gill (Gr., *κτείς*, comb + *Gobius*)

619. **C. stigmaticus** (Poey). Elongate, the depth 5 to 6. D. VI–11 or 12; A. 12 or 13. Scales 27. Light greenish, with several dark blotches on head and along middle of sides. Woods Hole to Brazil, rare N. (Gr., *στιγμάτικος*, spotted.)

620. **C. glaucofraenum** (Gill). Tawny, with a faint blue spot on each scale; 6 dark spots along spinous D.; another row from scapular region and another along middle of sides; a straight blue line across cheeks. N. C. to Fla. Keys. (Lat., *glaucus*, glaucous; *fraenum*, bridle.)

366. MICROGOBIUS Poey (Gr., *μικρός*, small + *Gobius*)

621. **M. eulepis** Eigenmann & Eigenmann. Yellowish, no definite bars or spots on body; 1st D. with black spot. Head 4; depth 5½. D. VII–15 to 17. A. 16 or 17. Scales 50–14. Va. and N. C. (Gr., *εὖ*, well; *λεπίς*, scale.)

622. **M. holmesi** Smith. Green, with pale crossbars anteriorly; 1st D. with 4 rows of blotches. Head 3⅝; depth 5. D. VII–16; A. 18. Scales 48–12. N. C. (To Prof. J. A. Holmes.)

367. EVERMANNICHTHYS Metzelaar
(To Barton Warren Evermann + Gr., *ἰχθύς*, fish)

623. **E. spongicola** (Radcliffe). Sponge Goby. D. VI–13; A. 11. Head long and slender, 4.5; depth 6.4; snout pointed. Brown with more or less indistinct crossbars; D. and A. with a darkened margin. N. C. to Fla., living in the cavities of sponges (Lat., *spongia*, sponge; *colo*, I inhabit.)

368. GOBIOSOMA Girard (*Gobius* + Gr., *σῶμα*, body)

624. **G. boscii** (Lacépède). Body moderately chubby; cheeks tumid. Olive, with darker cross-shades. Head 3⅓; depth 5 to 6. D. VII–14. A. 10, L. 2½. Cape Cod to S. C. (To M. Bosc, once French consul at Charleston.)

Order XXXII. HAPLODOCI

This group shows no close relation to any other of our families. On account of the simple post-temporal (bifurcate in most fishes), Professor Cope has made

of the *Batrachoididae* a special group, the *Haplodoci*. (Gr., ἁπλόs, simple; δόκη, for post-temporal bone.)

Family CXXV. BATRACHOIDIDAE (The Toadfishes)

Body depressed anteriorly, with compressed tail; head large, depressed, with well-developed mucous channels; mouth very large, with strong teeth; gills 3, a slit behind the last; no pseudobranchiae; gill membranes broadly united to isthmus; no bony suborbital stay; post-temporal (suprascapula) undivided; scales cycloid, small or wanting; dorsals separate, the first of 2 or 3 low stout spines, the second, like the anal, many-rayed. V. jugular, I, 2 or I, 3. P. broad, procurrent; no pyloric caeca. Vertebrae 30 to 45. Carnivorous fishes, chiefly of warm seas, some of them reaching a very large size. The young attach themselves to rocks by means of an adhesive ventral disk, which soon disappears. Some species have poison glands at base of dorsal and opercular spines, and some have luminous glands on sides.

a. Body naked; lateral line indistinct, without shining bodies; dorsal spines 3; a foramen in the axil of P.; no poison glands; teeth strong, blunt. . . . . Opsanus, 369.
aa. Body naked; lateral lines several, accompanied by phosphorescent spots; dorsal spines 2; no foramen in axil of P.; some canines. . . . . Porichthys, 370.

369. OPSANUS Rafinesque

(*Batrachus* of authors, not of Schneider, which is based on a scaly species earlier called *Batrachoides* by Lacépède)

(Gr., ὤψ, eye; ἄνω, upward ["means looking up." *Raf.*])

625. **O. tau** (Linnaeus). Toadfish. Oyster Fish. Sapo. Pores on jaws with cirri; subopercle with a strong spine. Blackish green, with dark markings; fins with dark bars. Head $2\frac{2}{3}$; depth $4\frac{1}{3}$. D. III–27. A. 24. L. 18. Cape Cod to W. I., very abundant among rocks and seaweed. (Gr., ταῦ, the letter T, from the form of the bones of the top of the head.)

370. PORICHTHYS Girard (Gr., πόρος, pore; ἰχθύς, fish)

626. **P. porosissimus** (Cuvier & Valenciennes). Bagre Sapo. Light brown, clouded with dark on head; a row of dark blotches on side. Teeth few in palatine (4 or 5), in part developed as very strong canines. N. C. to Argentina (Lat., most porous.)

Order XXXIII. XENOPTERYGII

A little group of small fishes, distinguished by the peculiar sucking disk at the breast, formed from the skin of the body and not from the ventral fins. There is no spinous dorsal nor suborbital ring, and the palatine arcade is

materially modified. No scales. The relations of these fishes are obscure, but they are probably descended from Batrachoid forms. (Gr., ξενός, strange; πτερύξ, fin.)

Family CXXVI. GOBIESOCIDAE (The Clingfishes)

Body elongate, the head very broad and depressed, the skin smooth, naked; mouth moderate; upper jaw protractile; teeth conical or incisor-like; opercle reduced to a spine; pseudobranchiae small or wanting; gills $2\frac{1}{2}$ or 3; gill membranes broadly united; D. small, posterior, similar to anal, both of soft rays only; V. I, 4 or I, 5; the fins wide apart, and between them a very large sucking disk composed of folds of skin. No air bladder. Vertebrae 26 to 36. Small carnivorous fishes of the warm seas, living in tide pools and clinging firmly to stones. Species few, mostly American.

a. Gill membranes free from isthmus; gills 3; lower jaw with incisors; posterior part of sucking disk without free anterior margin. . . . . Gobiesox, 371.

371. GOBIESOX Lacépède (*Gobius* + *Esox*)

627. G. strumosus Cope. Lower incisors not serrate. Head very wide, its width $2\frac{5}{6}$ in total (with C.); eye small; teeth 24/22; no canines. Plumbeous, fins blackish. D. 11. A. 10. Va. to Fla., scarce. (Lat., swollen.)

Order XXXIV. DERIPIA[1]

This artificial and temporary group embraces those spiny rayed fishes, other than the Haplodoci, in which the ventral fins, when present, are inserted before the pectorals, and which have the rays of these fins typically fewer than I, 5. The many families fall into a few primary groups, which are not yet satisfactorily separated nor defined. (Gr., δέρη, neck; πούς, foot.)

Family CXXVII. CALLIONYMIDAE (The Dragonets)

Body elongate, naked; head broad and depressed; preopercle armed with a strong spine, usually branched. First D. of 3 or 4 flexible spines; V. I, 5, widely separated, located before P.

372. CALLIONYMUS Linnaeus (Gr., κάλλος, beauty; ὄνομα, name)

628. C. calliurus Eigenmann & Eigenmann. D. IV, 6; A. 4. Preopercular spine with 2 barbs, the anterior turned forward. Anterior parts with white and black spots. N. C. to Florida Keys. (Gr., κάλλος, beauty; οὐρά, tail.)

[1] Rafinesque's name *Deripia* seems to be the oldest applied to this group. It seems preferable to the adjective *Jugulares*, of later date.

Family CXXVIII. URANOSCOPIDAE (The Stargazers)

Body elongate, tapering behind; scales usually small, cycloid; lateral line mostly obsolete. Head cuboid, usually mailed above and on cheeks. Eyes small, on front of top of head. Mouth vertical, the lower jaw prominent, the lips mostly fringed; teeth small; premaxillaries protractile; maxillary broad, simple, not slipping under the preorbital. Gill openings very wide, the membranes free; gills 3½, a small slit behind the last. Pseudobranchiae present. Naked skin on top of head sometimes covering a battery of electric cells. Spinous D. very short, sometimes wanting; the soft D. and A. many-rayed. P. with broad, oblique base; V. jugular, I, 5. No air bladder. Carnivorous fishes of the shores in warm regions. Species few.

a. Dorsal fins 2; head without spines, an electric organ under the naked skin above.
b. Head above, with a Y-shaped ridge extending forward from the occiput, on each side of the trapezoidal, naked (electric) area. . . . . Astroscopus, 373.

373. ASTROSCOPUS Brevoort
(Gr., ἄστρον, star; σκοπέω, to look)

629. **A. y-graecum** (Cuvier & Valenciennes). Stargazer. Brownish, everywhere finely spotted with white, each spot with a dark ring; C. with lengthwise stripes; naked space between forks of Y long and narrow; no spines before eyes. Head 2⅔; depth 3⅓; D. IV–13. A. 12. Scales 113. L. 10. South Atlantic Coast, N. to N. J. (Name from armature of head, suggesting the Greek letter upsilon, Υ.)

630. **A. guttatus** Abbott. Pale spots without dark edge. Naked space between forks of Y short and broad; 2 spines before eye. D. IV–13. A. 13. Long Island to Va., rare. (Lat. spotted, as with rain drops.)

Family CXXIX. BLENNIIDAE (The Blennies)

Body oblong or variously elongate, naked; teeth well developed, long, slender, comb-like, in front of jaw only; suborbital ring without "stay"; D. moderate, continuous, or divided; the anterior half of spines mostly flexible; anal rather long; V. jugular, few rayed; C. present; tail not isocercal; pseudobranchiae present; air bladder usually wanting. Vert. 30 to 40. Species numerous, mostly inhabiting shallow seas and rock pools, in warm regions. The scaly blennies of the tropics constitute the family *Clinidae*.

a. Gill membranes broadly united to the isthmus, the gill openings restricted to the sides.
b. Mouth large; head pointed; no canines. . . . . Chasmodes, 374.
bb. Mouth small, the head blunt in profile.
c. Canine teeth none. . . . . Hypsoblennius, 375.
cc. Canine teeth in one or both jaws behind the other teeth. . . Hypleurochilus, 376.
aa. Gill membranes free from the isthmus, forming a broad fold across it; posterior canines present. . . . . Blennius, 377.

374. CHASMODES Cuvier & Valenciennes (Gr., *χασμώδης*, yawning)

631. **C. bosquianus** (Lacépède). Orbital tentacle minute or wanting; maxillary reaching beyond eye; ♂ olive-green, with 9 blue lines; head and 1st D. with orange; ♀ dark green, reticulated and barred. Head 3½; depth 3½. D. XI, 19. A. 20. L. 3. N. Y. to La. (To M. Bosc, Consul, a zealous collector of fishes of S. C.)

375. HYPSOBLENNIUS Gill (Gr., *ὕψο*, high; *Blennius*) (*Isesthes* Jordan & Gilbert)

632. **H. hentz** (Le Sueur). Body rather deep; orbital cirrus bifid at tip, as long as D. spines. D. high, the spines stiff. Olive, with vague bars; head with distinct black spots. Head 3⅔; depth 3½. D. XII, 15. A. 19. L. 2½. Md. to La. (To Hentz, an early entomologist.)

376. HYPLEUROCHILUS Gill (Gr., *ὗ*, upsilon; *πλευρόν*, side; *χεῖλος*, lip)

633. **H. geminatus** (Wood). Orbital cirrus branched, very high in ♂; D. spines slender. Olive-brown, back and fins with black spots in ♂. Head 3½; depth 4. D. XI, 15. A. 18. L. 2½. Va. to Texas, with the two preceding and others, creeping among oyster shells and clusters of tunicates; also about ballast piles. (Lat., twin.)

377. BLENNIUS Linnaeus (Old name, from Gr., *βλέννα*, slime)

634. **B. foxi** Fowler. Body robust, compressed; orbital cirrus long, nearly half head with 2 smaller ones at the base on each side; mouth small; a posterior canine in each jaw; dorsal fin continuous, not notched. Color gray, with 7 dusky crossbars, the anterior partly divided above, these extending on the fins; head marbled; a black spot between 1st 2 dorsal spines above. Sea Isle City, Cape May, N. J., taken near tide mark. (To William J. Fox.)

Note. Other species of *Blennius* have been reported from our limits, but the identifications have been questioned.

Family CXXX. PHOLIDAE (The Gunnels)

Body elongate, covered with very small scales; no lateral line; teeth conic, not comb-like, mostly equal; gill openings not continued forward below; the membranes broadly united across isthmus; ventrals very small or wanting; dorsal rays very numerous, of spines only, these usually short and stiff; A. commonly with 2 spines; vertebrae many; paropophyses of precaudal vertebrae united below. Carnivorous fishes of rocky shores in Northern regions, especially in the Pacific. Size small.

a. Ventral fins present, of a spine and one soft ray; anal spines small; head naked.
Pholis, 378.

378. PHOLIS Scopoli (*Muraenoides* Lacépède; *Gunnellus* Cuvier)
(Gr., φολίς, old name of some blenny)

635. **P. gunnellus** (Linnaeus). Butterfish. Gunnel. Brown, with darker bars, black ocellated spots along base of D. Head 8; depth 9. D. LXXVIII. A. II, 38. V. I, 1. Vert. 85. L. 12. Labrador to N. J., in seaweed, common N. (*Eu.*) (From "Gunnel" (gunwale), its English name.)

Family CXXXI. STICHAEIDAE (The Snake Blennies)

Body elongate, covered with small scales; dorsal fin many-rayed, composed entirely of rather high spines; gill openings prolonged forward below, separated by a narrow isthmus; teeth conic, subequal; pectorals long; ventrals rather long, I, 3 or I, 4. Herbivorous species inhabiting seaweed on northern shores, especially in the Pacific.

a. Lateral line well developed, running high.
  b. Lateral line forked, a lower fork wanting. . . . . Ulvaria, 379.
  bb. Lateral line simple. . . . . Stichaeus, 380.
aa. Lateral line obscure; teeth on jaws only.
  c. Pectorals with the middle rays longest; teeth lacking on vomer and small or wanting on palatines. . . . . Lumpenus, 381.
  cc. Pectorals with the upper and middle rays shortened, shorter than the lower; teeth on vomer and palatines. . . . . Leptoclinus, 382.

379. ULVARIA Jordan & Evermann (*Ulva*, the green sea lettuce)

636. **U. subbifurcata** (Storer). Brownish with pale blotches; black bars on head; D. with black dots; lateral line with upper branch only, the lower branch (developed in *Eumesogrammus*) wanting. Head $4\frac{1}{3}$; depth 5. D. XLIV. A. 30. Woods Hole and N., rather rare. (Lat., almost twice forked.)

380. STICHAEUS Reinhardt (Gr., στιχάω, to set in rows)

637. **S. punctatus** (Fabricius). Scarlet; D. with black spots. Head $4\frac{1}{2}$; depth about $6\frac{1}{2}$. D. XL. A. I, 35. Cape Cod to Greenland. (Lat., spotted.)

381. LUMPENUS Reinhardt (*Lumpen*, a Danish name)

638. **L. lampetraeformis** (Walbaum). Head small. Olive, with pale shades; D. with oblique white bands. Head 9; depth 15. D. LXXV. A. 50. V. I, 3. L. 12. Cape Cod, N. (Lat., lamprey-formed.)

382. LEPTOCLINUS Gill (Gr., λεπτός, slender; *Clinus*)

639. **L. maculatus** (Fries). Langborn. Head 5. Yellowish; irregularly covered with dark spots. D. LVIII to LX. A. 35 to 38. Arctic Ocean, rare S. to Mass. Bay (Lat., spotted.)

Family CXXXII. CRYPTACANTHODIDAE (The Wrymouths)

Head cuboid, with vertical cheeks, conspicuous muciferous channels in jaws and preopercle; top of head flat; snout short; lower jaw very heavy, cleft of mouth vertical; teeth conical, on jaws and vomer, gill membranes joined to the narrow isthmus; P. short; V. wanting; D. very long, of spines only, enveloped in thick skin; D., A., and C. joined. Body naked or scaly. Vertebrae many. Species few. Large fishes of Arctic regions.

a. Body scaleless; palatines with teeth. . . . . Cryptacanthodes, 383.

383. CRYPTACANTHODES Storer (Gr., κρυπτός, hidden; ἄκανθα, spine)

640. **C. maculatus** Storer. Wrymouth. Ghostfish. Brown, with dark spots, rarely immaculate. Head 6½; depth 13. D. LXXIII. A. 50. L. 24. N. Atl., Labrador to L. I. (Lat., spotted.)

Family CXXXIII. ANARHICHADIDAE (The Wolf Fishes)

Large Blenny-like fishes with the body robust, the vomer very thick and solid, the jaws with 2 series of coarse molar teeth; palatines with similar teeth; jaws with canines in front, the posterior teeth below molar. Scales rudimentary; no lateral line; gill membranes joined to isthmus. D. high, of flexible spines only. V. wanting. Air bladder present. Vertebrae numerous. Voracious fishes of northern seas; one of them commonly taken off our coast.

a. Tail not very long, with a caudal fin, distinct from D. and A. (*Anarhichadinae.*)
b. Dorsal spines 60 to 70.
c. Vomerine teeth extending much farther backward than palatine teeth. Anarhichas, 384.
cc. Vomerine teeth not extending farther backward than palatine teeth. Lycichthys, 385.

384. ANARHICHAS (Artedi) Linnaeus (Ancient name, from Gr., ἀναρρι-χαόμαι, to scramble up)

641. **A. lupus** Linnaeus. Wolf Fish. Vomerine teeth extending much farther back than palatine. Brown, sides with 9 to 12 black bars, continued on D., besides dark spots and reticulations. Head 6; depth 5½. D. LXII. A. 42. L. 4 feet. Arctic, S. to N. J., not rare. (*Eu.*) (Lat., wolf.)

642. **A. minor** Olafsen. Yellowish without black bars, back and sides with round black spots. Head 5⅓; depth 5½. D. LXVII. A. 46. Arctic, S. to Mass. Bay. (Lat., smaller.)

385. LYCICHTHYS Steenstrup and Hallgrimson (Gr., λύκος, wolf; ἰχθύς, fish)

643. **L. latifrons** (Steenstrup & Hallgrimson). Head 5, depth 4; D. LXVII. A. 45. Color brown, obscurely marked, no distinct bars, or spots. Arctic, S. to Grand Banks. (*Eu.*) (Lat., *latus*, broad; *frons*, forehead.)

Family CXXXIV. ZOARCIDAE (The Eelpouts)

Body more or less eel-shaped, naked or with small, cycloid scales; mouth large, with conical teeth; head unarmed; gill membranes united to isthmus; pseudobranchiae present; gills 4. D. and A. long and low, of soft rays only, or with a few spines in posterior part of D. P. small. Vertical fins confluent around the tail. V. jugular, imperfect or wanting; lateral line median or obsolete. Vertebrae in large number. Species rather numerous, abounding in Arctic seas, in cold or deep waters.

a. Dorsal with several (15 to 20) of its last rays very short and spine-like; scales present; lateral line present, teeth strong, in jaws only; viviparous. (*Zoarcinae.*)
b. Dorsal rays about 130; anal 105. (*Macrozoarces* Gill). . . . . Zoarces, 386.
aa. Dorsal fin without spines. (*Lycodinae.*)
c. Scales present; body not greatly elongate; lateral line weak or obsolete; vomer with teeth. . . . . Lycodes, 387.

386. ZOARCES Cuvier (Gr., ξωαρκής, viviparous)

644. **Z. anguillaris** (Peck). Eelpout. Muttonfish. Mother of Eels. Brownish, mottled with olive. Head 6; depth 6. D. 95, XVIII, 17. A. 105. L. 20. Labrador, S. to N. C., common N. (Lat., like an eel.)

387. LYCODES Reinhardt (Gr., λυκώδης, wolfish)

645. **L. reticulatus** Reinhardt. Brownish, with reticulated black lines, disposed in 5 cross-bands; dorsal dark-edged, with dark vertical lines. Head 4; depth 8. D. 94. A. 75. V. 4. L. 12. N. Atl. S. to R. I., in 17 to 140 fathoms. (*Eu.*) Several other species of *Lycodes* and related genera occur N. and in deep water. (Lat., reticulated.)

Family CXXXV. OPHIDIIDAE (The Donzellas)

Body elongate, naked or covered with very small scales which are placed in oblique series at right angles to one another; mouth large, with villiform or cardiform teeth. Gill openings wide, the gill membranes narrowly joined to the isthmus, behind V.; pseudobranchiae small or wanting. Gills 4. Vertical fins low, of soft rays only, confluent around the isocercal tail. Ventral fins at the throat, each developed as a long forked barbel. Air bladder present. Species few, small, carnivorous fishes of the warm seas.

a. Body scaly; head naked; palatines with a band of villiform teeth only; opercle with spine; teeth in jaws fixed; air bladder short and broad, with a foramen below. Rissola, 388.

388. RISSOLA Jordan & Evermann (Named for Anastase Risso, of Nice, an early and competent naturalist)

646. **R. marginata** (De Kay). Brownish, D. & A. edged with black; gill rakers 4; V. as long as head. Head 6½; depth 7½; fin rays very numerous. Southern Coast, N. to N. Y. (Lat., margined.)

Family CXXXVI. AMMODYTIDAE (The Sand Lances)

Body elongate, compressed, with small, cycloid scales; lateral line along side of back; mouth large, toothless, the chin projecting; upper jaw very protractile; gill membranes separate, free; gill rakers long and slender; pseudobranchiae large; no barbels; D. long and low, of soft rays only; A. similar, shorter; C. forked; ventrals jugular, or wanting (present in the related genus *Embolichthys* of the tropical family *Bleekeriidae*). P. low. No air bladder. Vertebrae 63. Species few. Small silvery fishes swimming in large schools, and burying themselves in sand by a quick movement. Coasts of N. regions.

a. Ventral fins wanting; body with many transverse oblique folds; a fold of skin along edge of belly. (*Ammodytinae*.)
b. Vomer unarmed. . . . . Ammodytes, 389.

389. AMMODYTES (Artedi) Linnaeus (Gr., ἄμμος, sand; δύτης, diver)

647. **A. americanus** De Kay. Sand Lance. Lant. Olivaceous; a steely lateral stripe; P. reaching front of D. Head $4\frac{3}{4}$; depth 10. N. Atlantic, S. to N. J.; common N. Very close to the European *A. tobianus* L., but in the American form the dorsal begins a little farther back. (Low Lat., American.)

Order XXXV. PLECTOGNATHI (The Plectognaths)

Premaxillaries coössified with the maxillaries, and dentary with the articular; post-temporal undivided, grown fast to the skull; interopercle rod-like; upper pharyngeals forming vertical transverse laminae; skin naked or variously covered with rough scales, shields, or spines. Vertebrae usually in less than normal number, 15 to 30. Ventral fins reduced or wanting. This order is a modified offshoot of the group of *Squamipennes*, to which the *Chaetodontidae* and *Acanthuridae* among the *Percomorphi* belong. The relations of *Balistidae* with *Acanthuridae* are especially close. (Gr., πλεκτός, joined; γνάθος, jaw.)

Note. Several plectognath fishes, other than those listed below, as well as species of *Acanthurus*, stray northward at times along our coast.

Suborder SCLERODERMI

Scales on skin rough. 1 to 3 dorsal spines present.

Family CXXXVII. BALISTIDAE (The Trigger Fishes)

Body ovate, compressed, covered with large rough scales of varying structure. Mouth small, terminal, low; jaws short, each with one or more series of separate incisor-like teeth; eye very high. Gill openings small, slit-like. Dorsals separate, the 1st of 3 spines; 2d D. and A. long; V. wanting; pubic

bone long, movable, with sometimes a spine at its end. Species numerous; carnivorous fishes of tropical seas.

a. Dorsal spines 3; body covered with thick, firm scales; pelvis with a blunt spine; a groove before eye; larger plates behind eye; gill opening large; dorsal and anal falcate. BALISTES, 390

390. BALISTES (Artedi) Linnaeus (Gr., *βαλίστης*, one who shoots, from the short trigger-like 2d spine of D., which under pressure releases the 1st)

648. **B. capriscus** Gmelin. TRIGGER FISH. LEATHERJACKET. Soft D. high, falcate; a groove before eye; large plates behind gill opening; teeth white; no spines on side of tail. C. lobes elongate in adult; ventral flap spinulose. Brownish, young spotted with darker; 2d D. and A. with interrupted brown streaks; C. mottled; scales on head similar to those on body. Head 3; depth $1\frac{4}{5}$. D. III–27. A. 25. Lat. l. 51 to 62. L. 18. Warm seas, rarely N. to Cape Cod. (*Eu.*) (Lat., *capra*, goat.)

649. **B. vetula** Linnaeus. OLD WIFE. LEATHERJACKET. Dorsal and caudal with filamentous lobes. Two blue streaks on sides of head. D. III, 29; A. 27. Median portion of lateral line indistinguishable. Warm Atlantic, rare N. (Lat., old woman.)

FAMILY CXXXVIII. MONACANTHIDAE (THE FILEFISHES)

Body much compressed, covered with rough, velvety skin. First dorsal reduced to one spine, usually followed by a rudiment; ventrals wanting; the long pubic bone sometimes with a movable spine at its end. Tropical fishes of most warm seas, not valued as food, the flesh dry and bitter.

a. Pubic spine present, movable; gill-slit short, nearly vertical, dorsal spine with retrorse barbs. A. 25 to 35. (*Monacanthinae.*) . . . . . MONACANTHUS, 391.
aa. Pubic spine wanting; gill-slit long, oblique. A. 36 to 50. (*Aluterinae.*) CERATACANTHUS, 392.

391. MONACANTHUS Cuvier (Gr., *μονός*, one; *ἄκανθα*, spine)

a. Pubic spine movable; ventral flap moderate, not extending beyond it; dorsal spine with retrorse barbs. (*Stephanolepis* Gill.)

650. **M. hispidus** (Linnaeus). FILEFISH. FOOLFISH. No recurved spines on side of tail; first soft ray of D. sometimes filamentous. Dull greenish, mottled with darker. Head $3\frac{2}{3}$; depth $1\frac{3}{4}$. D. I–32. A. 32. L. 6. Mass. Bay to Cuba, common S. (Lat., rough.)

392. CERATACANTHUS Gill (Gr., *κέρας*, horn; *ἄκανθα*, spine)

651. **O. schoepfii** (Walbaum). ORANGE FILEFISH. Dull greenish, marbled with darker; D. spine slender, not barbed; C. long, in young, shorter with age. Head $3\frac{2}{3}$; depth $2\frac{1}{3}$. D. I–36. A. 38. L. 18. Maine to Texas, not rare.

(To Johann David Schöpf, a Hessian surgeon in the Revolution, an excellent naturalist.)

Suborder GYMNODONTES

(Skin prickly or naked; no fin spines; jaw bones more or less coössified, and tending to take the place of the teeth)

Family CXXXIX. TETRAODONTIDAE (The Swellfishes)

Body oblong, little compressed, the skin naked and usually prickly; stomach capable of great inflation; jaw bones separate on each side, and forming a sort of beak; no fin spines; D. opposite A.; C. distinct; V. wanting; P. short; pelvic bone moderate. Gill openings small; nostrils various, sometimes closed; air bladder present. Species numerous in warm and temperate seas. They are noted for their power of swallowing air, by which the stomach may be greatly inflated and the fish float belly upward out of reach of its pursuers. Some of the tropical species (*Ovoides*, etc.) are very poisonous, the venom being mainly in the ovary.

a. Skin without scutes; back rounded; nostril on each side with two openings.
b. D. and A. falcate, of 12 to 15 rays; C. mostly lunate; vertebrae 20; mucous tubes on head very conspicuous. . . . . Lagocephalus, 393.
bb. D. and A. short, rounded, of 6 to 8 rays; C. rounded; vertebrae 18; nostrils at tip of a hollow papilla; mucous tubes not conspicuous. . . . . Sphaeroides, 394.

393. LAGOCEPHALUS Swainson (Gr., λαγώς, hare; κεφαλή, head)

652. **L. laevigatus** (Linnaeus). Rabbit Fish. Smooth Puffer. Tambor. Olive green; silver white below; belly with large 3-rooted spines; skin elsewhere smooth. Head $3\frac{1}{4}$; depth $4\frac{1}{2}$. D. 14. A. 12. L. 2 feet or more. Cape Cod to Brazil. (Lat., made smooth.)

394. SPHAEROIDES Lacépède (Gr., σφαίροιδης, like a ball)

653. **S. maculatus** (Schneider). Common Puffer. Swellfish. Swell-toad. Sides of head and body always prickly, as is the back from upper lip to D.; prickles all similar, small, close-set, 3-rooted. Dark olive above, marbled and dotted with black; black blotches on side, forming short crossbars; C. nearly plain. Head $2\frac{2}{3}$; depth 3. D. 7. A. 6. C. 7. L. 12. Maine to S. C., very common. (*Tetraodon turgidus* Mitchill.) (Lat., spotted.)

Family CXL. DIODONTIDAE (The Porcupine Fishes)

Fishes related to the *Tetraodontidae*, but having the bones of each jaw grown into one; body with strong, rooted spines; stomach less extensively inflatable than in the *Tetraodontidae;* each bony plate with a short, fixed spine. Species few, in most seas.

a. Dermal ossifications robust, all fixed, and 3-rooted (some of them rarely 4-rooted); nasal tube simple, with two lateral openings, subcylindrical, not divided. Cyclichthys, 395.

395. CYCLICHTHYS Kaup (Gr., κύκλος, circle; ἰχθύς, fish)

654. **C. schoepfi** (Walbaum). Burr Fish. Swelltoad. A ridge above eye. Greenish, with series of parallel blackish stripes covering most of the body above; an ocellated black spot above P.; a larger one behind it; one at base of D.; a smaller one below it; fins unspotted. Head $2\frac{3}{4}$; depth 3. D. 12. A. 10. L. 6. Mass. Bay to Texas; very abundant S. (Farther S. occurs **Diodon hystrix** Linnaeus, the Porcupine Fish, often preserved in collections, larger, with much longer spines, of which some are 2-rooted and movable. It also straggles N., at least to Woods Hole.) (To Johann David Schöpf.)

396. LYOSPHAERA Evermann & Kendall (Gr., λύω, to make loose; σφαῖρα, ball)

655. **L. globosa** Evermann & Kendall. Yellowish with numerous hexagonal dark spots, smallest on back; a papilla in center of each spot. Atl. Coast, rare, known from Va. to Fla. D. 11. A. 4. L. of type, $1\frac{3}{4}$ inches, probably a larva, but if so the adult is unknown. (Lat., globose.)

Family CXLI. MOLIDAE (The Headfishes)

Body deep, compressed, truncate behind, so that there is no caudal peduncle; skin scaleless, rough. Mouth very small, the jaw bones united, without median suture, as in *Diodontidae*. D. and A. of soft rays only, confluent around tail, each fin elevated in front. V. wanting; pelvic bone small; belly not inflatable. Three species, in as many genera; large fishes of the open sea, consisting apparently of an enormous fish head to which small fins are attached.

a. Body ovate, not twice as long as deep; skin thick, leathery, without hexagonal plates; caudal not pointed. . . . . Mola, 397.

397. MOLA Kölreuter (*Orthagoriscus* Schneider) (Lat., millstone)

656. **M. mola** (Linnaeus). Sunfish. Headfish. Mola. Dark gray, silver gray below, a dusky bar along bases of vertical fins. D. and A. very high; C. concave, little developed; form varying greatly with age; a hump on snout above mouth in old specimens. Head 3; depth $1\frac{3}{5}$ (in adult). D. 17. A. 16. L. 6 feet or more. Pelagic, N. to Bay of Fundy and Brit. Col.; not rare; sometimes weighing 2000 lb. or more. (*Eu.*)

Suborder OSTRACODERMI (Body in a box-like carapace)

Family CXLII. OSTRACIIDAE (The Trunkfishes)

Body enclosed in a hard, trunk-like carapace, 3-, 4- or 5-angled, and formed of polygonal bony plates, firmly joined at the edges; teeth separate; no fin spines. Unique fishes of tropical seas.

a. Carapace bridged behind anal.
b. Carapace spined, at least posteriorly.

c. Frontal region without horns. . . . . LACTOPHRYS, 398.
cc. Frontal region with 2 strong horns. . . . . ACANTHOSTRACION, 399.
bb. Carapace without spines. . . . . RHINESOMUS, 400.

398. LACTOPHRYS Swainson (Lat., *lac*, milk; Gr., *ὀφρύς*, eyebrow)

657. **L. trigonus** (Linnaeus). TRUNKFISH. SHELLFISH. CHAPIN. Gray, a blue spot on each plate; scutes dark-edged. W. I., N. in Gulf Stream to Cape Cod. (Gr., *τρεῖς*, three; *γόνος*, angle.)

399. ACANTHOSTRACION Bleeker

658. **A. tricorne** (Linnaeus). Bluish, colors duller. W. I., N. in Gulf Stream to Cape Cod. Known by the strong horns. (Lat., three horned.)

400. RHINESOMUS Swainson (Gr., *ῥίνη*, file; *σῶμα*, body)

659. **R. triqueter** (Linnaeus). TRUNKFISH. Light olive, with greenish blue spots about as long as pupil. W. I. to Woods Hole. (Lat., 3 angled.)

ORDER XXXVI. PEDICULATI (THE PEDICULATE FISHES)

Carpal bones reduced in number and notably elongate, forming a kind of arm which supports the broad pectoral. Gill opening reduced to a small pore in or near the axil, behind the pectoral fins, V. jugular, if present; first vertebra united with skull; post-temporal broad, flat, simple; pharyngeals reduced in number; spinous dorsal often reduced to isolated tentacles. No scales.

This singular group is probably a modified offshoot of the Haplodoci (*Batrachoididae*) or of some similar form. It may fairly be placed at the end of the fish series, as having gone further in its divergence from the original fish stock than any other of the groups called " orders " among fishes. It is not, however, in any proper sense the " highest " of the fishes, for some of its peculiarities are due to degradation. Still less is it at all closely related to higher vertebrates. Most of the *Pediculati* belong to the tropics or to the deep sea. (Lat., *pediculatus*, provided with a little foot or peduncle.)

FAMILY CXLIII. OGCOCEPHALIDAE (THE BATFISHES)

Head broad and depressed, snout elevated, trunk short and slender. Mouth small, inferior; gill opening very small, above and behind axil of P. Body and head covered with bony tubercles. Spinous D. a single tentacle on snout, retractile into a cavity beneath a long process. Species few, all American.

401. OGCOCEPHALUS Fischer (*Malthe* Cuvier) (Gr., *ὀγκός*, hooked; *κεφαλή*, head)

660. **O. vespertilio** (Linnaeus). BATFISH. DIABLO. Dark gray, reddish below; forehead produced in a long rough process, of variable length. D. I, 4. A. 4. L. 6. Warm seas, very rarely N., common in Fla. (Lat., bat.)

661. **O. radiatus** (Mitchill). Batfish. Similar to *vespertilio*, but with the rostral process reduced to a button-like tubercle. N. C. to Fla. (Lat., rayed.)

Family CXLIV. ANTENNARIIDAE (The Frogfishes)

Head and body somewhat compressed, the mouth nearly vertical, the chin projecting; gill openings small, pore-like, in lower axil of P. Spinous D. of 1 to 3 isolated tentacles. Species numerous, in warm seas, living in floating seaweed, and cavities in coral reefs, walking about on their leg-like P. and V. (Lat., *antenna*, a feeler.)

a. Head compressed; dorsal spines 3; skin smooth, with many fleshy tags; V. long. Histrio, 402.

402. HISTRIO Fischer (*Pterophryne* Gill) (Lat., a harlequin)

662. **H. pictus** (Linnaeus). Mouse Fish. Yellowish, much marbled; wrist slender. Head $2\frac{1}{4}$; depth $1\frac{1}{8}$. D. III–14. A. 7. V. 5. L. 5. Warm seas, occasional N. in Gulf Stream, living in floating masses of *Sargassum*. (Numerous species of the related genus, *Antennarius* Cuvier, with rougher skin and shorter limbs, occur in the tropics; one of them, **A. teleplanus** Fowler, was once taken on Cape May.) (Lat., painted.)

Family CXLV. LOPHIIDAE (The Anglers)

Head very wide, depressed; body contracted, tapering, scarcely longer than head; mouth enormously wide, with a stomach proportionate; teeth very strong, unequal, some of them long, sharp canines and most of them depressible; strong teeth on vomer and palatines. Gill openings large, in lower axil of P. Skin smooth, with many dermal flaps. Spinous D. of 3 isolated tentacles, with many dermal flaps, and 3 spines joined by membrane, the 1st spine enlarged at tip and extending over the mouth, serving as a bait for smaller fishes. Large fishes of the cool seas, remarkable for greediness.

403. LOPHIUS (Artedi) Linnaeus (Old name from Gr., λόφος, crest)

663. **L. piscatorius** Linnaeus. Angler. Fishing Frog. Allmouth. Bellows Fish. Goosefish. Brownish, mottled; mouth behind tongue, unspotted. D. III–III, 10. A. 9. V. I, 5. Vertebrae 30. L. 3 feet or more. N. Atl., S. to Cape Lookout, common N. The eggs of this fish are remarkable, in ribbon-like bands, pink in color, 30 to 40 feet long and a foot in width. These float near the surface in summer. (Lat., angling.)

With this monstrous creature, unexcelled for pure ugliness in the class to which it belongs, we may close the long series of fishes.

Class F **AMPHIBIA** (The Batrachians)

The Amphibians are cold-blooded vertebrates, intermediate between the Fishes and the Reptiles. They differ from the Fishes chiefly (1) in the absence of rayed fins, paired limbs usually being developed and (when functional) having the skeleton elements of the limbs of Reptiles, and (2) in the reduction or absence of the various bones of the branchial, opercular, and suspensory systems. "The undivided cartilaginous coracoid of *Polypterus* (a Crossopterygian fish) has a tubercle articulating with diverging rods; in the one we have the rudiment of the humerus, in the other the representatives of the ulna and radius, while the undifferentiated cartilage between the diverging rods is material for the carpal bones, and in bones radiating from that cartilage are the homologues of the metacarpals. The attempts of a primitive animal of such a type to travel on land might develop the fore limb, and a hind one would follow in sympathy with the other. Then we would have the first of the quadruped vertebrates." (Gill.) The Amphibians undergo a more or less complete metamorphosis; the young "tadpoles" being fish-like and more or less aquatic, breathing by means of external gills. These differ from the gills of Fishes in standing on fleshy processes of the branchial bones and not on the bones themselves. In the tadpole, the tail is provided with a more or less distinct fin-like membrane, which usually disappears with age. Later in life, lungs are developed, and in most cases the gills disappear. Skin mostly naked and moist, used to some extent as an organ of respiration. Heart with 2 auricles and a single ventricle.

Reproduction is by means of eggs which are of comparatively small size, without hard shell. These are deposited in water or in damp places. In a few salamanders and frogs the young are born alive. Six orders of *Amphibia* are recognized at present, three of these being extinct. The order *Apoda* (*Gymnophiona*) (blind, limbless, burrowing, tropical forms) is unrepresented in our limits. A single family, *Coeciliidae*, with 59 species. (Gr., ἀμφι, both; βιός, living.)

Orders of Amphibia

a. Body long, with a distinct tail throughout life; hind limbs, if present, not especially enlarged. . . . . Caudata, XXXVII.

aa. Body short, depressed; tail disappearing with age; limbs 4, the posterior much enlarged. Salientia, XXXVIII.

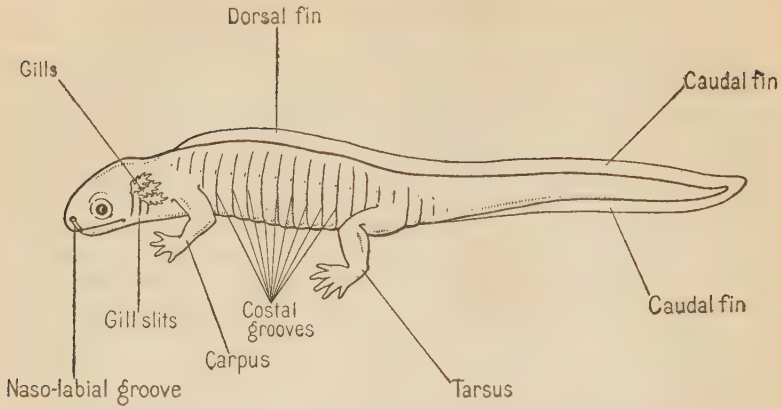


FIG. 2. Diagrammatic outline to show the location of the external features mentioned in describing the species in the order *Caudata* (Salamanders).

ORDER XXXVII. CAUDATA (THE SALAMANDERS)

Body elongate, subterete or depressed; both jaws with teeth or horny beaks; 4 limbs present or hind limbs wanting; hind limbs not markedly longer than fore; tail present throughout life; gills external, present or absent in the developed adult. The suborders and families of *Caudata* are based chiefly on technical characters, most of which can be ascertained only by a careful study of the osteology. "It may be stated as characteristic of the *Batrachia* in general that their characters cannot be determined without a study of the skeleton." (*Cope.*) (Lat., with a tail.)

Families of Caudata

a. Jaws with teeth; 4 limbs present.
  b. External gills normally disappearing in adult life; no anterior projection of pelvis; normally an ypsiloid cartilage; maxilla present (Suborder *Mutabilia*).
    c. Salamander-shaped; limbs well developed.
      d. Flattened; no eyelids; a single gill-slit or spiracle on side of neck; teeth on prevomers close to and paralleling maxillary teeth. . CRYPTOBRANCHIDAE, CXLVI.
      dd. Not flattened; eyelids present; no gill-slit; teeth on prevomers well removed from those on maxillae.
        e. No groove from lip to nostril; no patches of teeth on parasphenoid; lungs present; ypsiloid cartilage developed.
          f. Costal grooves not marked; teeth on prevomers in two longitudinal rows diverging posteriorly; a postfronto-squamosal arch. PLEURODELIDAE, CXLVII.
          ff. Costal grooves marked; teeth on prevomers in a transverse row; no postfronto-squamosal arch. . . . . AMBYSTOMIDAE, CXLVIII.

ee. A groove from lip to nostril; patches of teeth on the parasphenoid; lungs absent; no ypsiloid apparatus; costal grooves marked; teeth on prevomers transverse. PLETHODONTIDAE, CXLIX.

cc. Eel-shaped; limbs rudimentary; no eyelids; a gill-slit on neck; teeth on prevomers in two longitudinal rows diverging posteriorly. . . . . AMPHIUMIDAE, CL.

bb. External gills retained in adult life; an anterior projection of pelvis; no ypsiloid cartilage; maxilla absent (Suborder *Proteida*). . . . . NECTURIDAE, CLI.

aa. Jaws with horny beaks; hind limbs absent; eel-shaped; no maxilla; external gills present (Suborder *Meantes*). . . . . SIRENIDAE, CLII.

FAMILY CXLVI. CRYPTOBRANCHIDAE

(THE GIANT SALAMANDERS)

Body robust, flattened, with well-developed limbs; an orifice on each side of neck, usually persistent throughout life; tongue covering floor of mouth; vomerine teeth in series parallel to maxillary teeth; nostrils very small; no external gills; toes 4–5. Aquatic. Genera 2, species (1) the giant *Megalobatrachus japonicus*, of Japan and China, and (2) the following:

a. Spiracles persistent; gill arches 4. . . . . CRYPTOBRANCHUS, 404.

404. CRYPTOBRANCHUS Leuckart (Gr., *κρυπτός*, concealed; *βράγχος*, gill)

664. **C. alleganiensis** (Daudin). HELLBENDER. Blackish; side of body with a thick fold of skin. L. 24. L. Erie to Ohio Valley, S., in large streams. A large and very unprepossessing but harmless creature. (Lat., Alleghenian.)

FAMILY CXLVII. PLEURODELIDAE

(THE NEWTS)

Vertebrae opisthocoelian, convex in front, concave behind; carpus and tarsus ossified; palatine teeth in 2 longitudinal series, diverging backwards; no parasphenoid teeth; lungs present; no naso-labial groove; species largely aquatic, numerous in Europe and Asia.

a. Tongue small, thick, attached by nearly its whole inferior surface; toes 4–5, outer and interior toe on hind foot rudimentary; tail compressed. . . . . TRITURUS, 405.

405. TRITURUS Rafinesque. (*Notophthalmus* and *Diemyctylus*, Rafinesque) (Gr., *τρίτον*, salamander; *οὐρά*, tail)

665. **T. viridescens** (Rafinesque). NEWT. EVET. EFT. Above olive green or reddish of varying shades; lemon yellow below; side of back with a row of scarlet dots, each surrounded by a black ring; back with a pale streak; belly, with small black dots; head with three longitudinal grooves; 3 large pores behind eye. L. 3½. E. U. S., abundant N. and N. E., in ponds, from which it migrates more or less in the breeding season. The Red Eft is a subadult stage in the life of the newt, not a separate variant or species. It

is smaller and bright vermilion-red, with the skin rougher. It is found in the same region but away from water, under logs, etc., coming out after rain. (Lat., greenish.)

Family CXLVIII. AMBYSTOMIDAE

(The Mole Salamanders)

Vertebrae amphicoelian; carpus and tarsus ossified; toes 4–5, not webbed; tongue thick; a row of teeth across posterior part of prevomer; no teeth on parasphenoids. Species North American. The larvae of *Ambystoma* often reach a large size before the gills disappear, and sometimes breed while in this condition. These were formerly considered as forming a separate genus, *Siredon*, supposed to be allied to *Necturus*.

a. Tongue sub-circular, with radiating folds, its lateral borders free; palatine teeth in a transverse series, continuous or interrupted; tail compressed; mucous pores before eye. Ambystoma, 406.

406. AMBYSTOMA Tschudi (Gr., ἄμβυξ, the rounded top of a cup; στόμα, mouth, the name erroneously altered to *Amblystoma*)

a. Costal grooves 10 to 12; vomerine series extending behind nares.
b. Two distinct tubercles on sole.

666. **A. talpoideum** (Holbrook). Mole Salamander. Blackish brown, with gray, lichen-like markings; costal grooves 10; tail short, compressed, 2½ in length; head very broad; body short and squat. Southern, N. to S. Ill. (Lat., mole-like).

667. **A. tigrinum** (Green). Tiger Salamander. Dark brown, usually with many irregular yellow blotches, sometimes arranged in cross-bands; body thick and strong; 12 costal grooves; the head comparatively long; tail not much, if any, longer than head and body; color varying from uniform brown to yellow, but usually spotted; no dorsal stripe. L. 8. N. Y. to Minn., S. to Mexico; common. The young, called *Axolotl*, sometimes breed while retaining the external gills. (Lat., tiger-like.)

bb. Sole with one tubercle, or none.

668. **A. maculatum** (Shaw). Spotted Salamander. Black above with a series of round yellow spots on each side of the back; body broad, depressed and swollen; skin punctate, with small pores from which exudes a milky fluid; 2 or 3 clusters of enlarged pores on head; a strong dorsal groove; tail 2⅓ in length; costal grooves 11. Large. L. 6. Nova Scotia to Wisc. and S.; common. (Lat., spotted.)

669. **A. opacum** (Gravenhorst). Black above, with about 14 white bars; belly dark blue; costal grooves 11; no dorsal furrow; no enlarged pores on

the head; tail 2½ in total length; body stout. L. 3½. Mass. to Wisc., and S. (Lat., dark).

670. **A. jeffersonianum** (Green). Olive brown or blackish, usually with pale or bluish spots, but sometimes uniform plumbeous. Head small, eyes far back; body slender; costal grooves 10; fore limb not reaching hinder when appressed. L. 5 to 8. Va. to Ind. and N.; common, variable. (Lat., of Jefferson College.)

671. **A. macrodactylum** Baird. Blackish, a yellow dorsal stripe; slender; toes long; costal grooves 12. L. 5. Iowa and W. (*A. stejnegeri* Ruthven.) (Gr., *μακρός*, long; *δάκτῡλος*, finger.)

aa. Costal grooves 14; vomerine series entirely between nares.

672. **A. texanum** (Matthes). Blackish, usually with plumbeous shades and specks; head small, short, broad; body slender; skin very smooth and slippery; snout very short, the lower jaw projecting beyond it. Costal grooves 14. Va. to Kansas and Texas. (*A. microstomum* Cope.) (Lat., Texan.)

Family CXLIX. PLETHODONTIDAE

(Lungless Salamanders)

Vertebrae amphicoelian or opisthocoelian. Carpus and tarsus cartilaginous; palatine teeth transverse; dentigerous plates on parasphenoid; a groove from nostril to lip; no lungs; no ypsiloid apparatus; no pterygoid bone. Species numerous, chiefly North American; either terrestrial or mountain-brook forms.

a. Tongue attached in front.
  b. Toes 4–5; tail without basal constriction.
    c. Eyes normal; skin with much pigment.
      d. A light line from eye to angle of jaw; lower jaw immovable, mouth opened by lifting head; occipital condyles stalked; atlas with transverse collar. Desmognathus, 407.
      dd. No light line from eye to angle of jaw; lower jaw movable; condyles sessile; atlas normal.
        e. Tail cylindrical; terrestrial; head without conspicuous pores; vomerine and parasphenoid series not continuous.
          f. Teeth small, not confined to front of mouth; maxilla normal; tips of toes not dilated; two premaxillae. . . . . Plethodon, 408.
          ff. Teeth large, confined to front of mouth; hind part of maxilla knife-edged; tips of digits swollen; two premaxillae. . . . . Aneides, 410.
        ee. Tail compressed; aquatic; head with conspicuous pores; vomerine and parasphenoid series continuous. . . . . Stereochilus, 411.
    cc. Eyes scarcely functional; almost without pigment; blind, white, cave-dwelling salamanders. . . . . Typhlotriton, 412.
  bb. Toes 4–4; tail with basal constriction; belly white with black dots. Hemidactylium, 409.

aa. Tongue free in front, attached only by a central stalk.
  b. A marked ridge (canthus rostralis) and a pale line from eye to nostril; two premaxillae; vomerine and parasphenoid series continuous. . . . . Gyrinophilus, 413.
  bb. No ridge or line from eye to nostril; one premaxilla.
    c. Stout; red; vomerine and parasphenoid series continuous. . . Pseudotriton, 414.
    cc. Slender; usually yellow; vomerine and parasphenoid series not continuous. Eurycea, 415.

407. DESMOGNATHUS Baird

(Gr., δεσμός, band; γνάθος, jaw)

a. Belly uniform black; tail short, flattened and finned.

673. **D. quadra-maculatus** (Holbrook). Black above and below; stout; vomerine teeth always present; aquatic. L. 6. Va. to Ga., in the mountains. (Lat., with square spots.)

aa. Belly light or mottled; tail long, not flat.

674. **D. phoca** (Matthes). Grayish brown, mottled with darker; belly uniform pale; tail long, keeled above; vomerine teeth always present; semi-aquatic. L. 5. Pa. to Ga., common in the mountains. (Lat., a seal.)

675. **D. fuscus** (Rafinesque). Brown, with a light dorsal band; old individuals may be uniform dark above; belly mottled; tail long, keeled above; vomerine teeth lost by adult males; semi-aquatic. L. 5. Can. to Tex. and Fla. (Lat., brown.) Represented in the Coastal Plain from Va. S. by subsp. **auriculatus** Holbrook, with a row of light dots on sides and belly much darker. (Lat., eared.) Represented in the mountains from Va. to Ga. by subsp. **carolinensis** Dunn, much smaller, L. 3, tail cylindrical, terrestrial. (Lat., Carolinian.) Represented in the mountains from W. Va. to N. Y. by subsp. **ochrophaeus** Cope, like *carolinensis* but with an immaculate, straight-edged dorsal band, and belly lighter; terrestrial. (Gr., ὠχρός, yellow; φαιός, dusky.)

408. PLETHODON Tschudi (Gr., πλεθός, many; ὀδών, tooth)

a. Large species; belly uniform; usually white pigment flecks on dorsal surface; costal grooves 14–17; 0–4 costal folds between appressed toes.

676. **P. yonahlossee** Dunn. White pigment flecks on sides only; young with paired red dorsal spots; adult with a red dorsal band on body; costal grooves 14; stout. L. 6. Mts., Va. and N. C. (For Yonahlossee Road, N. C.)

677. **P. wehrlei** Fowler and Dunn. White pigment flecks on sides only; usually two rows of tiny red dots on back; slender; costal grooves 17. L. 6. Mts., Pa. to W. Va. (To R. W. Wehrle.)

678. **P. glutinosus** (Green). Black; white pigment flecks on sides and back; costal grooves 14; stout. L. 6. N. Y. to Fla. and Tex. Common. (Lat., sticky.)

679. **P. metcalfi** Brimley. No white pigment flecks; gray; slender; 14 costal grooves. L. 5. Mts., N. C., and Va. (To Z. P. Metcalf.)

aa. Small species; belly mottled; no white pigment flecks; costal grooves 16–20; 6–8 costal folds between appressed toes.

680. **P. dorsalis** Cope. Costal grooves 16–17; usually a zigzag dorsal light band; occasionally adults plumbeous with darker mottling. L. 3. S. Ohio and S. (Lat., of the back.)

681. **P. cinereus** (Green). Costal grooves 19–20; either a straight dorsal light stripe or uniform plumbeous. L. 3½. Can. to N. C. and Mo. Common under logs; nocturnal and very active. (Lat., ashy.)

409. HEMIDACTYLIUM Tschudi (Gr., *ἡμί*, half; *δάκτῡλος*, finger)

682. **H. scutatum** (Schlegel). Brown above; snout yellow; white below, with dots like ink spots; body short; tail slender; tail with constriction at base, where it readily breaks off. Costal grooves 14. L. 2½. Mass. to Ill., and S. (Lat., scaled.)

410. ANEIDES Baird (Gr., *ἀνεῖδης*, not comely)

683. **A. aeneus** (Cope & Packard). Black, with large blotches of greenish or coppery; costal grooves 14; toes dilated at tip. Teeth enlarged, confined to front part of mouth; hind part of maxilla knife-edged. L. 4. Cumberland Mts. in Va. and Tenn. (Lat., bronze.)

411. STEREOCHILUS Cope (Gr., *στερεός*, fat; *χεῖλος*, lip)

684. **S. marginatus** (Hallowell). Yellowish brown with numerous brown streaks on sides, belly yellow, speckled; tail compressed, body slender. Aquatic; Dismal Swamp, Va., and S. (Lat., margined.)

412. TYPHLOTRITON Stejneger (Gr., *τυφλός*, blind + *Triton*, a genus of Salamanders)

685. **T. spelaeus** Stejneger. Costal grooves 16; tail slightly compressed, not finned; vomerine teeth in 2 V-shaped series with the curvatures directed forward, often continuous with parasphenoid series; eyes rudimentary; color uniformly pale. L. 4. Caves in Mo. A blind cave dweller. (Lat., of the cave.)

413. GYRINOPHILUS Cope (Gr., *γῦρινος*, tadpole; *φιλέω*, to love)

686. **G. porphyriticus** (Green). Salmon red above, white below, with irregular darker mottlings; head long; a ridge and a light line from eye to nostril; tail flattened, finned. Costal grooves 17. L. 7½. Aquatic. Ontario to Ohio, in the mountains. (Gr., *πορφῦριτικός*, crimson.)

414. PSEUDOTRITON Baird (Gr., *ψεῦδης*, false + *Triton*)

687. **P. montanus** Baird. Red, with a few round black dots; tail short; rounded at base, compressed but not keeled. Costal grooves 17. L. 7. Pa. to Ky. and Ga. (Lat., mountain.)

688. **P. ruber** (Sonnini). Red Salamander. Vermilion red, with numerous crowded, rather irregular black spots; head wide; tail shorter than body;

costal grooves 16. L. 6. N. Y. to Ga. and Ohio. Old specimens often nearly black above. (Lat., red.) Subsp. **nitidus** Dunn, with no spots on distal half of tail, and spotting very distinct; Mts., N. C. and Va. (Lat., shining.)

415. EURYCEA Rafinesque (derivation unknown)

(*Spelerpes* Rafinesque)

a. Costal grooves 13 to 15.

b. Tail about as long as rest of body.

689. **E. bislineata** (Green). Yellow, with a dark line along each side of the back; belly unspotted; tail not keeled anteriorly; costal grooves 14 or 15, rather faint. L. 3. Can. to Ill. and S. (Lat., two striped.) Subsp. **wilderae** Dunn, with dark stripe broken on tail; mts., N. C. and Va. (To Mrs. H. H. Wilder.)

bb. Tail much longer than rest of body.

690. **E. gutto-lineata** (Holbrook). Yellow, with black stripe on back and one on side; tail black, barred with yellow; belly mottled; tail keeled; costal grooves 13. L. 6. Va. to La. (Lat., spotted-striped.)

691. **E. longicauda** (Green). Orange yellow; back and sides with many irregular small black spots; middorsal line spotted; belly spotless; tail keeled, spotted, or barred with black. L. 6. Costal grooves 13. N. Y. and S. (Lat., long-tailed.)

692. **E. lucifuga** Rafinesque. Costal grooves 15; vermilion red above, irregularly spotted with dark brown; sides of tail similarly spotted, not barred. Ind. to Mo., entering caves, common. L. 6. (*Spelerpes maculicauda* Cope.) (Lat., fleeing light.)

693. **E. melanopleura** (Cope). Yellow, spotted with black; no spots on middorsal line; tail not barred; costal grooves 13. Mo. and Ark. L. 6. (Gr., μελάς, black; πλεῦρα, sides.)

aa. Costal grooves 20.

694. **E. multiplicata** (Cope). Color brown; costal grooves 20. L. 3. Mo. to N. Mex. (Lat., many folded.)

Family CL. AMPHIUMIDAE (The Congo Snakes)

Body elongate, eel-shaped; limbs rudimentary, with 2 or 3 toes each; a spiracle on each side of neck; tongue indistinct, wholly adherent; a strong series of vomerine teeth parallel with the teeth in jaws. Tail short, compressed. Two species, inhabiting the ditches and streams of the S. U. S.

416. AMPHIUMA Garden (derivation unknown)

695. **A. means** Garden. Congo Snake. Blind Eel. Toes 2. Blackish above and below. L. 24. Va. to La. (Lat., swift-moving.)

696. **A. tridactylum** Cuvier. Toes 3; larger; dark above; lighter below. L. 36. S. Ind. to La. (Gr., τρεῖς, three; δάκτῡλος, finger.)

Family CLI. NECTURIDAE (The Mud Puppies)

Salamanders, provided with bushy external gills, and having the branchial clefts remaining open through life; pelvis with anterior projection; no ypsiloid cartilage; no maxilla; teeth well developed; limbs 4. Species two; the related *Proteus*, inhabiting caves in S. W. Austria, is blind, nearly colorless, and has the toes 3–2.

a. Toes 4–4; tongue large, free in front; vomerine teeth in one strong series; eyes small, but perfect. . . . . Necturus, 417.

417. NECTURUS Rafinesque (Gr., νήκτης, swimmer; οὐρά, tail)

697. **N. maculosus** Rafinesque. Mud Puppy (N.). Water Dog (S.). Brown, much speckled; young with a lateral band; gills large and bushy, bright red, forming 3 tufts on each side; a strong fold across throat; head broad, depressed; tail much compressed. E. U. S., chiefly N. and W. of the Alleghenies, abundant in the Great Lakes Region. L. 24. An animal very useful to anatomists. (Lat., spotted.)

Family CLII. SIRENIDAE (The Sirens)

Body elongated, eel-like, with no posterior limbs, not even a vestige of pelvis; head flattened; snout obtuse; mouth narrow, jaws with horny sheaths; no maxilla, vomer with 2 large patches of teeth; eye very small; lips thick; tail compressed, finned. These creatures represent, in a degree, a tadpole stage in development. Like tadpoles, they are herbivorous. Species 2 — *Pseudobranchus striatus* (Le C.), of Georgia, a small species with 3 toes and with one gill slit; and the following:

a. Three gill slits; toes 4 . . . . . Siren, 418.

418. SIREN Linnaeus (Gr., Σειρήν, a Siren)

698. **S. lacertina** Linnaeus. Mud Eel. Tail much shorter than rest of body, pointed at tip. Blackish, sometimes dotted. L. 36. Lowland streams and swamps, S. Ind. to N. C. and S. (Lat., like a lizard.)

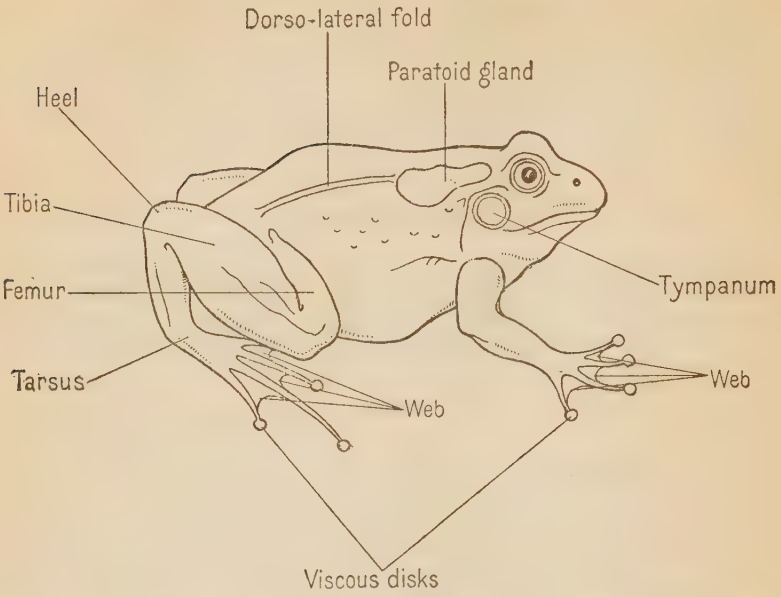


Fig. 3. Diagrammatic outline to show the location of the external features mentioned in describing the species in the order *Salientia* (Toads and Frogs).

Order XXXVIII. SALIENTIA The Tailless Batrachians

Body short and broad; all 4 limbs present, the hinder limbs long and strong, adapted for leaping; lower jaw usually toothless; tail absorbed in the adult. Young (tadpole) fish-like, with broad head, internal gills, a long tail, no limbs and no teeth; the intestinal canal very long, adapted for a vegetable diet; from this form by degrees it develops into the adult animal, which is always more or less frog-like. (Lat., leaping.)

Families of Salientia

a. Tongue present, adherent in front, more or less free behind; eustachian tubes widely separated.

b. Thoracic [1] region capable of expansion; (*arciferous*) the free and divergent ends of the coracoid and precoracoid connected by 2 longitudinal cartilaginous bands, the cartilage of one side overlapping the other. Toads and Tree Toads.

c. Upper jaw toothless; toes webbed, not dilated at tip; paratoids (glandular bodies behind ear) present; skin with warts; terrestrial . . . . . Bufonidae, CLIV.

[1] To understand the character of the structure here briefly described, the student should dissect a Toad (*arciferous*) and a Frog (*firmisternial*).

Key to families of Salientia for the Northeast
Adapted from Handbook of Frogs and Toads by
A. A. and A. H. Wright

A. Waist wide; body broad and thick; hind limbs short

B. Size small (19-41 mm.); with transverse fold of skin across head behind eyes; no tympanum; no parotids.....Brevicipitidae

BB. Size larger (37-220 mm.); no transverse fold of skin across head

C. No cranial crests; skin relatively smooth.....Pelobatidae

CC. Cranial crests present; skin with warts .....Bufonidae

AA. Waist narrow; body narrower and thinner; hin limbs long; no parotid.

D. Disks present on digits....Hylidae

DD. No disks present on digits Ranidae

cc. Upper jaw with teeth.
d. Fingers and toes tapering, without viscid disks; our species with a sharp flat-edged spur at heel; paratoids present; subterranean . . . . PELOBATIDAE, CLIII.
dd. Fingers and toes more or less dilated at their tips, this dilation forming a viscid disk; paratoids none, in our species; chiefly arboreal. . . . . HYLIDAE, CLV.
bb. Thoracic region incapable of expansion (*firmisternial*), the 2 bands of cartilage united in a median mass between the adjacent ends of the nearly parallel coracoid and precoracoid bones. Neither paratoids nor digital disks in our species. Frogs.
e. Upper jaw toothless; diapophyses of sacral vertebrae dilated (tympanum hidden, no paratoids, and toes free in our species). . . . . BREVICIPITIDAE, CLVII.
ee. Upper jaw with teeth; no paratoids; toes webbed; tympanum evident; no viscid disks; sacral diapophyses scarcely dilated . . . . . RANIDAE, CLVI.

FAMILY CLIII. PELOBATIDAE (THE BURROWING TOADS)

Upper jaw with teeth, heel with a well-developed spur for digging. Species few, in Europe and America.

Forehead and crown bony, rough; skin slightly tuberculate; sacrum not coössified with coccyx; vomer with teeth; heel with a spade-like process covered by a horny sheath; toes more or less webbed. . . . . SCAPHIOPUS, 419.

419. SCAPHIOPUS Holbrook (Gr., *σκάφη*, spade; *πούς*, foot)

699. **S. holbrooki** (Harlan). SPADEFOOT. Olive brown, a yellowish band a each side. E. U. S., rare W. of Pa.; burrows in the ground. Extremely oisy in spring. "The machinery for producing sounds equal to an ordinary team whistle is apparently confined to the throat of this rare and curious Batrachian." (*C. C. Abbott.*) L. 3. (To Dr. J. E. Holbrook.)

FAMILY CLIV. BUFONIDAE (THE TOADS)

Jaws toothless; toes webbed, not dilated at their tips; sacral vertebrae with dilated processes; paratoids prominent. Living in most warm regions.

a. Snout not pointed; no lateral fold of skin; skin more or less warty. . . . BUFO, 420.

420. BUFO[1] Laurenti (Lat., toad)

700. **B. americanus** Holbrook. AMERICAN TOAD. COMMON TOAD. Upper urfaces of hind legs rough, with irregular enlarged, horny warts; body and ead very rugose and warty, more so with age; cranial crests very evident; me of the warts on the back always enlarged and horny; dark color-spots of k usually each with one enlarged wart; areolae on under surface rather arse, each with a minute horny pustule, in the adult. Color reddish brown blackish, never pale gray nor with a greenish tinge; under surface spotted; ely wholly brick red above; no pale streak along back (as in *B. boreas* of l.). Song a prolonged, high-pitched musical trill, heard in the breeding

[1] There are 2 Toads common within our limit, but their relations have been generally misunderstood. e are indebted to Mr. George S. Myers of Stanford University for an accurate definition of the 2 forms.

season, April and May. In upland regions, from Hudson Bay S. to Md., and much farther S. in Mts. (Lat., American.)

701. **B. fowleri** Garman. Fowler's Toad. Little Toad. Upper surfaces of hind legs usually with small inconspicuous warts; cranial crests inconspicuous; warts on back small, rarely enlarged and horny; several small warts of equal size in each color spot of the back; areolae of under surface very fine with no tiny horny spicules, the skin soft, light gray to dull drab, mostly with a slight greenish tinge; dark color spots usually conspicuous; colors rarely tinged with reddish brown; under surface spotted or not. Possibly occasionally interbreeding with *B. americanus*. Song a harsh trill, less prolonged than that of *B. americanus*. Mass. and N. Y., S. to Ga., W. to Mich. and Mo., and along the Gulf to Texas. Smaller, and decidedly a more dapper and active toad than *B. americanus*. (To S. P. Fowler.)

702. **B. terrestris** Bonnaterre. Generally similar to *americanus* but cranial crests prolonged backwards into a prominent knob; warts on back large; reddish brown. Dismal swamp, Va. and S. (Lat., terrestrial.)

Family CLV. **HYLIDAE** (The Tree Frogs)

Fingers and toes more or less dilated at their tips into viscous disks; upper jaw and vomer with teeth; lower parts usually covered with small warts; ear well developed. Species numerous, in most warm regions, especially abundant in tropical America; noted for their loud and varied voices, some of them being heard at all times from early spring until frost.

a. Disks small; palustrine.
b. Toes broadly webbed; tympanum indistinct. . . . . Acris, 421.
bb. Toes scarcely webbed; tympanum distinct. . . . . Pseudacris, 422.
aa. Disks round, conspicuous; arboreal. . . . . Hyla, 423.

421. **ACRIS** Duméril & Bibron (Gr., *ἀκρίς*, locust, from its sharp note)

703. A. gryllus (Le Conte). Cricket Frog. Hind legs very long. Brownish above; middle of back and head bright green or reddish brown; a dark triangle between the eyes; sides with 3 oblique blotches; a white line from eye to arm. L. 1½. E. U. S., in swamps, not on trees; its note resembles the rattling of pebbles. (Gr., *γρύλλος*, cricket.)

422. **PSEUDACRIS** Fitzinger (Gr., *ψεῦδης*, false + *Acris*).

704. P. feriarum (Baird). Swamp Tree Frog. Snout shortish, bluish ash, a dark dorsal stripe from snout backward, bifurcating above middle of body; a stripe on each side of this and one on side of head and body, the latter pale-edged below. L. 1. Variable. In swampy ground, rarely in trees. Its voice is a "rattle with a rising inflection at the end" (Cope), or

like the scraping of a coarse-toothed comb. E. U. S., W. to Ill. (Lat., of the *feriae*, or holidays.)

705. **P. triseriata** (Wied). Snout drawn out; width of head in length 3.5 to 3.6 times; heel reaching only to tympanic disk; length of body in total length of hind leg, 1¼ to 1½ times; color ashy brown, with 3 parallel dark stripes, the median often forking behind; a distinct spot on each eyelid. Allegheny Mts., to N. Mex. and Idaho. (Lat., three-striped.)

423. HYLA Laurenti (Gr., ἄλα, vocative of Hylas, friend of Hercules)

a. Fingers webbed at base; a white spot under eye; two phalanges of toe four free from web; warty.

706. **H. versicolor** Le Conte. Common Tree Toad. Rain Toad. Green, gray, or brown, with irregular dark blotches, the color changing; below yellow, behind white; tympanum ⅔ eye; fingers ⅓ webbed; skin with small warts. L. 2. E. U. S., W. to Kans. and La.; very abundant and variable. Its "clear, loud trilled rattle" is heard mostly in the evening and in damp weather. (Lat., color-changing.)

707. **H. phaeocrypta** Cope. Similar, but less warty; green marbling on hind surface of thigh; smaller. L. 1½. Call bird-like. S. Ill. to La. (Gr., φαιός, dusky; κρυπτός, hidden.)

aa. Fingers webbed at base; no white spot under eye; three phalanges of toe four free from web.

708. **H. femoralis** Latreille. Brown or gray; a triangular spot between eyes; an irregular blotch on back; a dark line on side; hind surface of thigh with yellow spots. L. 1. Dismal Swamp, Va., S. (Lat., of the thigh.)

aaa. Fingers not webbed.

b. Two phalanges of toe four free from web.

709. **H. cinerea** (Schneider). Green; a distinct narrow yellowish line along side of head and body, on outer edge of fore limb and posterior edge of hind limb; no bars on limbs; underneath yellowish white. L. 2. Southern, N. to Ill. and Va. (Lat., ashy.) Represented in Chesapeake Bay by subsp. **evittata** Miller, lacking the light lateral line. (Lat., unstriped.)

bb. Three phalanges of fourth toe free from web.

710. **H. crucifer** Wied. Spring Peeper. Yellowish brown or fawn-color, with dusky rhomboidal spots and lines, the latter usually arranged in the form of an oblique cross; head with lines; limbs barred; tympanum very obscure. L. 1. Manitoba to Me. and S. (*H. pickeringi* Holbrook.) (Lat. cross-bearing.)

711. **H. squirella** Latreille. Olive green, with irregular dark blotches; a dark bar between eyes; a white line along upper jaw to shoulder; greenish

white below, darker behind; throat with a few dark spots; legs marked with darker above; tympanum half eye. L. 1½. Ind. to Va. and S. (Eng., squirrel.)

712. **H. andersonii** Baird. Deep pea green; sides with irregular yellow spots; a green spot on throat; a purplish band; tympanum ⅓ eye. L. 1½. N. J. to S. C., in cedar swamps; rare. (From Anderson, S. C.)

Family CLVI. RANIDAE (The Frogs)

Teeth well developed on upper jaw, and usually on vomer also; toes 4–5, all more or less webbed; ear well developed. Species many, chiefly of the Northern Hemisphere and the East Indies. Most of them are aquatic, and similar to our common frogs.

a. Vomerine teeth present; no finger opposable to the others; tongue emarginate behind; hind toes full-webbed. . . . . Rana, 424.

424. RANA Linnaeus (Lat., frog)

a. Glandular dorso-lateral fold, if present, not extending to hip.
b. Glandular dorso-lateral fold absent or ill-defined.

713. **R. septentrionalis** Baird. Mink Frog. Olive brown, with paler vermiculations; sometimes a few dark blotches behind; pale below; femur and tibia equal, ½ length of body. L. 2½. N. E. to Montana and N. (Lat., northern.)

714. **R. catesbiana** Shaw. Bullfrog. Greenish, of varying shades, with small faint dark spots above; head usually bright pale green; legs blotched; ear large; toes broadly webbed; femur equal to tibia, not half body; L. 4 to 8. In ponds and sluggish rivers, common from Kansas E., introduced into Cal. Largest of our frogs; remarkable for its sonorous bass notes. (To Mark Catesby, who first figured the bullfrog.)

715. **R. virgatipes** Cope. No longitudinal glandular folds on back; tympanum equal to eye; webs rather short, 2 phalanges of 4th toe free; vomerine teeth between inner nares; interocular space ½ width of eyelid. Color above olive brown, with 2 light brown longitudinal bands on each side, the inferior band bounded below by a wide band of black spots; limbs blotched with black. L. 2½. N. J. to Fla., in swamps. (Lat., streaked-foot.)

bb. Glandular dorso-lateral fold not extending to hip.

716. **R. clamitans** Latreille. Green Frog. Spring Frog. Green or brownish, brighter in front; generally with irregular small black spots; arms and legs blotched, yellowish or white below; tympanum large; glandular folds large; toes well webbed; first fingers not extending beyond second; tibia and femur equal, ½ body. L. 3 to 5. E. U. S., common in springs. (Lat., loud-calling.)

aa. Glandular dorso-lateral fold present, well-defined, reaching hip.
b. Conspicuous dorsal spots; no black cheek patch.

717. **R. areolata** Baird. Brownish black, divided by narrow clay-colored lines into irregular circular blotches, largest behind; arms and legs barred or blotched; head broad, depressed; snout very obtuse; skin coarsely punctate; a deep hollow between nostril and eye; region above and behind ear swollen; glandular folds large; toes narrowly webbed. L. 3½; leg, 5½. N. Ind., Ill. and S. (Lat., with little areas, or spots.)

718. **R. pipiens** Schreber. Common Frog. Leopard Frog. Green, usually bright, with irregular black blotches edged with whitish, these mostly in 2 irregular rows on back; usually 2 spots between eyes; legs barred above; belly pale; head rather elongate. L. 2¾. N. Am., W. to Sierra Nevada, in ponds, very common. (Lat., chirping.)

719. **R. sphenocephala** Cope. Greenish, 2 irregular rows of dark spots; belly white. Similar to *R. pipiens* but head longer, not 3 in body; and a white dot in center of tympanum. A frog of the South Atlantic States, lately reported from larger rivers of central Indiana and from Va. (Gr., σφέν, wedge; κεφάλη, head.)

720. **R. palustris** Le Conte. Pickerel Frog. Light brown, with 2 rows of large oblong or square blotches of dark brown on back; one or two on sides; a brown spot above eye; a dark line from nostril to eye; upper jaw white, spotted with black; concealed surfaces of hind legs orange; head short, obtuse; toes well webbed; glandular folds low and broad. L. 2¾. E. U. S., in mountains, etc. (Lat., of the swamps.)

bb. No conspicuous dorsal spots; a black cheek patch.

721. **R. sylvatica** Le Conte. Wood Frog. Pale reddish brown; arms and legs barred above; head small, pointed; leg to heel longer than body; skin smooth; a rounded outer metatarsal tubercle present. L. 1⅜. E. U. S., W. to the plains; common in damp woods; an almost silent frog. (Lat., of the woods.)

722. **R. cantabrigensis** Baird. Very similar to preceding, leg to heel equal to or shorter than body; skin with small warts; often a narrow pale line along thighs behind and a dorsal line from snout to arms; back sometimes with dark spots; no outer metatarsal tubercle. Alaska and N., S. to central Ind. (Lat., of Cambridge, but in reality not found there.)

Family CLVII. BREVICIPITIDAE (The Toothless Frogs)

Frog-like, the maxillaries toothless and the diapophyses of the sacral vertebrae dilated. Species chiefly tropical.

a. Pupil erect; tongue elliptical; tympanum hidden; toes free; no precoracoids.
Gastrophryne, 425.

425. GASTROPHRYNE Fitzinger (*Engystoma* Fitzinger)

(Gr., γαστήρ, belly; φρύνη toad)

723. **G. carolinensis** (Holbrook). Snout obtuse, not twice eye; skin smooth; a fold across head behind eyes. Brown, dotted with paler below. L. 1. Southern U. S., N. to Va. and S. Ill.; rare. (Lat., of Carolina.)

Class G. REPTILIA (The Reptiles)

The Reptiles are cold-blooded, air-breathing vertebrates, usually scaly or covered with bony plates, or both, never with feathers or hair. The limbs, occasionally rudimentary or wanting, when well developed adapted for walking, climbing, burrowing, and swimming. There is an incomplete double circulation of the blood; the septum between the 2 ventricles being usually wanting or imperfect. The species are oviparous or ovoviviparous. Metamorphosis takes place within the egg, and the eggs are large and in oviparous forms mostly provided with a leathery skin. The skeleton is usually firm, and the nervous system is better developed than in the preceding groups. There are various other anatomical and embryological peculiarities of the Reptiles, too numerous to be noticed here. We may say, however, that the Reptiles are obviously distinguished from the Birds by the absence of feathers, and from the Amphibians by the presence of scales, and by the absence of gills after leaving the egg. The extinct forms of Reptiles are numerous, and their close relation with the earlier birds have led anatomists to bring the 2 classes into a single group, *Sauropsida*.

Several subclasses, orders, and suborders are recognized, the living forms in our area representing two subclasses, two orders, and four suborders. A 3d order (*Loricata*) is represented by 2 species, *Alligator mississippiensis* Daudin, in the lowland swamps of the South, and the rare *Crocodylus acutus* Cuvier of southern Florida.

Orders and Suborders of Reptilia

a. Body without dorsal and ventral bony shields, covered with small scales; jaws with teeth; anal opening a cross slit. . . . . (Subclass Parapsida), Order Squamata, XXXIX.

b. Mouth not dilatable; bones of mandible united by a bony suture in front, limbs 4 (rarely obsolete), shoulder girdle present; eyelids and tympanum usually evident. (Lizards.) Suborder Sauria.

bb. Mouth dilatable; bones of mandible united by ligament; limbs wanting (or represented by spurs near vent); no shoulder girdle; tympanum absent. (Snakes.) Suborder Serpentes.

aa. Body enclosed between bony shields (carapace and plastron), covered with large scales or leathery skin; head and neck retractile in the vertical plane in our species, tail withdrawn laterally; jaws without teeth; anal opening subcircular or a longitudinal slit. (Turtles.) . . . . . (Subclass Anapsida), Order Testudinata, XL.

c. Carapace and plastron covered with large scales, carapace with peripheral plates. Suborder Cryptodira.

cc. Carapace and plastron covered with a leathery skin; carapace without peripheral plates. Suborder Trionychoidea.

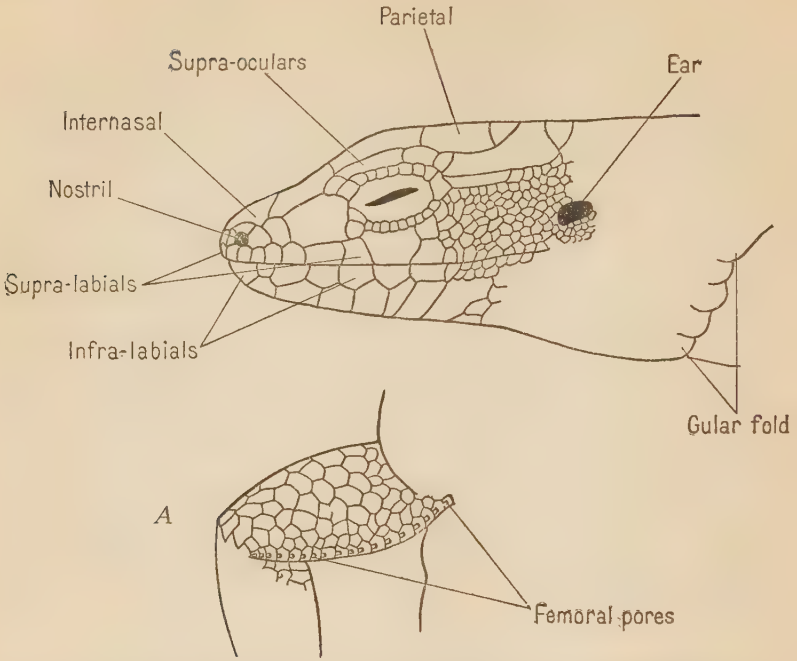


Fig. 4. Diagrammatic outline to show the location of the external features mentioned in describing the species in the suborder *Sauria* (Lizards). *A.*, hind leg of a lizard, showing the location of the femoral pores.

Order XXXIX. SQUAMATA

Suborder SAURIA (The Lizards)

Reptiles, not shielded, the body usually covered with scales; mouth not dilatable; jaws always with teeth; eyelids movable (all of our species), or transparent and fused over eye; limbs 4, distinct, rarely rudimentary and hidden by the skin; shoulder girdle developed. Feet usually with 5 digits. Tail usually long and in many cases very brittle, readily broken by a slight blow (this due to a thin, unossified, transverse septum, which traverses each caudal vertebra). "The vertebra naturally breaks with great readiness through the plane of the septum, and when such lizards are seized by the tail, that appendage is pretty certain to part at one of these weak points." (*Huxley.*) Vent a cross slit; quadrate bone articulated to the skull. The

great majority of the numerous species belong to tropical and sub-tropical regions. The few found within our limits give but a slight idea of the whole great group, being a mere overflow from the multitudes in the S. W. (Gr., σαῦρος, lizard.)

Families of Sauria

a. Tongue smooth or with villous papillae; clavicle not dilated proximally; limbs present or absent.
b. Temporal fossae without bony roof; tongue thick and not protractile; limbs present. IGUANIDAE, CLVIII.
bb. Temporal fossae with bony roof; tongue sheathed at top; scales with underlying bony plates; limbs obsolete in our species. . . . . ANGUIDAE, CLIX.
aa. Tongue covered with imbricate, scale-like papillae or with oblique folds; clavicle usually dilated proximally, often loop-shaped; limbs present in our species.
c. Premaxillary single; temporal fossae without bony roof; sternal fontanel present; tongue deeply bifid; femoral pores present. . . . . TEIIDAE, CLX.
cc. Premaxillary double; temporal fossae with bony roof; sternal fontanel usually wanting; tongue not deeply bifid; scales with underlying bony plates; femoral pores absent. . . . . SCINCIDAE, CLXI.

FAMILY CLVIII. IGUANIDAE (THE IGUANAS)

Tongue thick, villous, nearly or quite entirely fixed to the floor of the mouth, and little, if at all, notched in front; limbs present, temporal fossae without bony roof; pupil round; eyelids well developed; scales various; head generally with an enlarged interparietal scale; teeth subequal. Habits various; mostly insectivorous. A very large family, swarming in the hotter parts of America; extremely varied in appearance; some of very large size.

a. Femoral pores absent; toes dilated, with transverse lamellae inferiorly, the distal joint narrower, cylindrical or compressed, raised above the one before it; scales small or granular; ♂ with an inflatable gular sac; tail long, not prehensile; tympanum distinct; color green, changing to bronze. . . . . ANOLIS, 426.
aa. Femoral pores present; toes not dilated; ♂ without inflatable gular sac; tympanum exposed or hidden.
b. Head without spines; body not broad or strongly depressed.
c. 1 or 2 gular folds; upper head scales small; dorsal scales (in our species) very small.
d. Ear opening present; 1 gular fold. . . . . CROTAPHYTUS, 427.
dd. Ear opening absent; 2 gular folds. . . . . HOLBROOKIA, 428.
cc. No gular folds; upper head scales enlarged; dorsal scales large, imbricate, keeled. SCELOPORUS, 429.
bb. Head armed with bony spines; body short, depressed; scales unequal. PHRYNOSOMA, 430.

426. ANOLIS Daudin (A Native Name)

724. **A. carolinensis** Voigt. "CHAMELEON." Grass green; head brownish, the color changing at times in life to grayish, yellowish, bronze, or black; gular sac crimson, when inflated; head scales large and rough; scales of body subequal, keeled. L. 6. N. C. to Fla., W. to Rio Grande; common S. One of

the most beautiful lizards, rivaling the true chameleons of Old World in its changes of color. (Lat., Carolina.)

427. CROTAPHYTUS Holbrook (Gr., *κροτός*, rustling; *φυτόν*, plant)

725. **C. collaris** (Say). Mountain Boomer. Body short; head large; tail about 2 × length of head and body; enlarged head scales between orbital areas in one or two rows. Green or gray with small white or yellowish dots and obscure dusky crossbars; 2 black bands across the shoulders, with a broad yellowish band between, head darker. L. 12. Mo., Okla., and Tex., W. and N. to Idaho and Cal., S. into Mex. (Lat., with a collar.)

428. HOLBROOKIA Girard (To Dr. John Edwards Holbrook, author of *North American Herpetology*, etc.)

726. **H. maculata** Girard. Body depressed; tail subcylindrical, shorter than body in female and usually in male; no subcaudal spots. Gray above, vertebral region often lighter, with a series of darker, not sharply defined spots on each side; sometimes with scattered whitish spots; one or two black spots on each side of belly. L. 4½. Neb. and Wyo., S. to northern Tex. and Ariz. (Lat., spotted.)

429. SCELOPORUS Wiegmann (Gr., *σκέλος*, leg; *πόρος*, pore)

726 *a*. **S. undulatus** (Latreille). Subsp. **undulatus.** Dorsal scales rather large, strongly keeled, mucronate and arranged in nearly parallel rows, 32 to 48 in a row down the middle of the back; lateral scales directed obliquely backward and upward; femoral pores 11 to 17; male with enlarged post-anal plates. Olive, gray, brown, or nearly black, with 6 to 10 darker undulating cross-bands; no dorso-lateral stripes; throat and sides of belly in the male with brilliant blue and black; ventral surface of female yellow, white, or gray, often speckled with black. Forest areas of east. N. Am., cent. Pa. and N. J., S. W. through cent. Ohio, Ill., Mo., east. Okla., and Tex., S. to Fla. and the Gulf of Mex. (Lat., with wave-like markings.) Subsp. **thayerii** (Baird and Girard). Scales 28 to 44 in a row down the middle of back; 12 to 18 femoral pores. Smaller than *S. u. undulatus*. Brown, olive, or gray; male with 2 very distinct light dorso-lateral stripes (female much like *S. u. undulatus*). Male with throat and sides of belly blue and black; female may have blue on throat. Intergrading specimens occur over a wide area in east. Kans., cent. Okla., and east. Tex. S. Dak. to Ark., Ariz., and Mex. (For Sylvanus Thayer.)

430. PHRYNOSOMA Wiegmann (Gr., *φρῦνος*, toad; *σῶμα*, body)

727. **P. cornutum** (Harlan). Horned Toad. Tympanum not covered with scales; head bearing long spines; 2 rows of spines on each side of body;

back with large, spinose tubercles. Grayish or brownish above, with a more or less distinct light median dorsal streak, some dark brown spots — two on the nape. L. 5. Kans., W. to Colo., S. to Mex. (Lat., horned.)

Family CLIX. ANGUIDAE (The Slowworms)

Tongue of 3 parts, the posterior larger, thick, covered with villiform papillae; the anterior thin, emarginate, covered with scales, extensible and retractile into a sheath formed by a transverse fold at anterior extremity of posterior part, this sheath disappearing when the tongue is drawn out. Premaxillary single; dermal cranial ossifications roofing over the temporal fossa; clavicle slender; limbs present or absent, the shoulder girdle and pelvis always present; no abdominal ribs; bony plates underlying the scales; vertical plate on head present. Limbs sometimes wanting. Species few; mostly in warm regions.

a. Side with a conspicuous fold; limbs absent or hind limbs present as rudiments (wanting in our species); body snake-like, tail very brittle; external ear evident. Ophisaurus, 431

431. OPHISAURUS Daudin (Gr., ὄφις, snake; σαῦρος, lizard)

728. **O. ventralis** (Linnaeus). Glass Snake. Joint Snake. Ear much larger than nostril; dorsal scales in 14 rows and 120 transverse series; 10 rows on belly; scales on back obtusely keeled, others smooth. Greenish or brownish; sides largely yellow, with 3 narrow black streaks. L. 27. E. U. S., north to Va., Tenn., and Wisc., W. to N. Mex. (Lat., pertaining to belly, probably referring to locomotion.)

Family CLX. TEIIDAE (The Teiid Lizards)

Tongue flat, elongate, ending in 2 long, smooth points; its surface mostly covered with imbricate scale-like papillae; clavicle dilated proximally, limbs well developed or rudimentary (well developed in our species); premaxillary single; temporal fossae without bony roof; sternal fontanel present; femoral pores present. Species numerous, nearly all from tropical America.

a. Scaly portion of tongue arrowheaded, bifid, and not retractile posteriorly; tail not compressed; shields of head large, regular; eyelids developed; ear exposed; dorsal scales granular; ventral scales large, subquadrangular, forming regular series. Cnemidophorus, 432.

432. CNEMIDOPHORUS Wiegmann (Gr., κνήμις, leg-armor; φορός, bearing)

729. **C. sexlineatus** (Linnaeus). Olive or brownish gray, with 3 or 4 white or yellow stripes on each side, separated by blackish interspaces; belly bluish or greenish. L. 9½. Md. to Fla., W. to Ariz., S. into Mex., N. in Miss. Valley to Lake Mich. and S. Wisc. (Lat., six-lined.)

Family CLXI. SCINCIDAE (The Skinks)

Tongue moderately long, free, and feebly nicked in front, covered with imbricated scale-like papillae; premaxillary double; supratemporal fossae with bony roof; clavicle dilated and usually perforate; scales with underlying bony plates, femoral pores absent; limbs present or absent (present with 5 digits in our species). Generally distributed in tropical and temperate zones.

a. Palate toothless; no supranasal plates; anterior margin of ear not denticulate; lower eyelid with transparent disk. . . . . Leiolopisma, 433.
aa. Palate with teeth; 2 supranasal plates; anterior margin of ear denticulate; lower eyelid covered with scales. . . . . Eumeces, 434.

433. LEIOLOPISMA Duméril & Bibron (Gr., λεῖος, smooth; τόπισμα, husk)

730. **L. laterale** (Say). 28 to 32 scales around the body; a postnasal scale; length of hind-limb $2\frac{7}{8}$ to 3 times in length of head and body. Chestnut or olive brown above, sometimes irregularly spotted with dark brown; a black band edged with white on each side; abdomen yellow, tail blue below. L. $5\frac{4}{5}$. S. New Jersey to Fla., W. to Ill. and Tex. (Lat., lateral, referring to sides.)

434. EUMECES Wiegmann (*Plestiodon* Duméril)
(Gr., εὐμήκης, of good measure)

731. **E. anthracinus** (Baird). 24 scales around body; no postnasal scale. Dark bronze, with 4 narrow longitudinal yellow lines on the back, and on each side a broad black band; head sometimes red in adult; beneath yellowish. L. $5\frac{1}{2}$. N. Y., south to N. C., Mo., Ark., and Tex. (Lat., coal-color.)

732. **E. fasciatus** (Linnaeus). Blue-tailed Skink. "Scorpion." 28 rows of scales; usually a postnasal scale; length of hind limb not more than $2\frac{1}{2}$ times in the length of head and body. Dark olive, with 5 yellowish streaks, middle one forked on the head; tail long, usually bright blue; old specimens reddish olive, the stripes very faint or wanting; head becoming coppery red with age. L. 8 to 11. S. New Eng. to Fla., in Miss. Valley N. to Can., W. to Ariz. (Lat., striped, said of a bundle of sticks, *fasciae*.)

733. **E. multivirgatus** (Hallowell). 24–26 scales around body; 2 (1) postnasals; length of hind limb $3\frac{1}{3}$ times in length of head and body. Pale olive, with 4 or 5 stripes on each side of body. Neb. to N. Mex. and Colo. (Lat., many striped.)

734. **E. obsoletus** (Baird & Girard). 28 scales around body; a postnasal scale present or absent; length of hind limb may be less than 3, but usually over $2\frac{1}{2}$ times in length of head and body. Olive above, a part or all of the scales edged with dark brown; young black with or without 5 faint stripes. L. 10. Kans. to Utah, S. to N. Mex. (Lat., obsolete, referring to stripes.)

735. **E. septentrionalis** (Baird). 28 scales around body; no postnasal scale; length of hind limb 3 to $3\frac{1}{2}$ (usually 3) times in length of head and body.

Light green, with 4 dorsal black stripes; sides with 2 white stripes on either side of a black one. L. 7½. Minn., W. Iowa, Kans. and S. Dak. (Lat., of the north.)

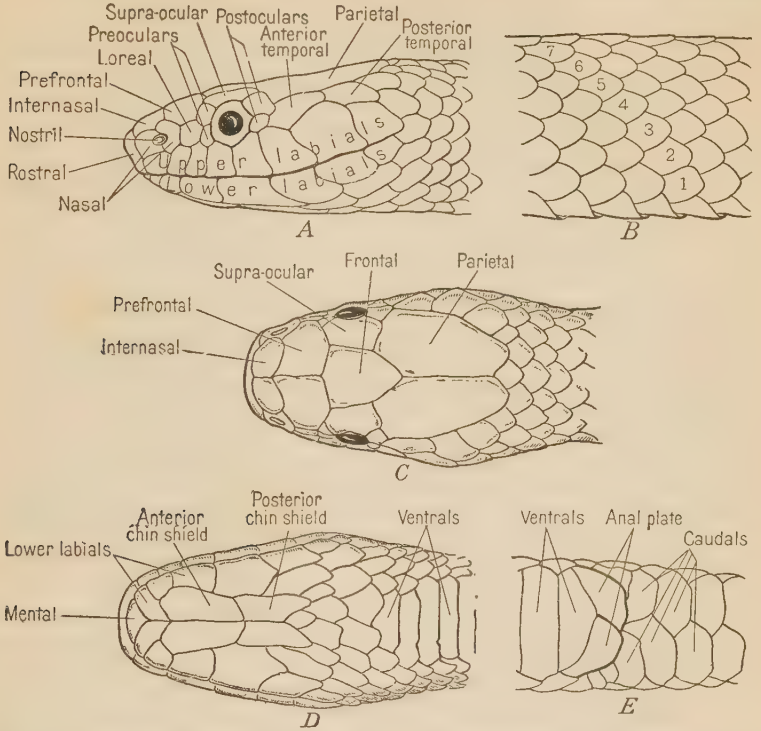


Fig. 5. Diagrams showing the positions and terminology of the scales in the species of the suborder *Serpentes* (Snakes). *A.*, scales on side of head; *B.*, portion of body, showing how the scale count is made; *C.*, dorsal scales on head; *D.*, ventral scales on head; *E.*, scales in anal region.

Suborder SERPENTES (The Serpents)

Reptiles with elongate, terete bodies, obsolete limbs, and an epidermal covering of imbricated scales, which is shed as a whole and replaced at regular intervals; mouth very dilatable; bones of both jaws and of palatopterygoid arch freely movable, united by ligaments only. The forelimbs and shoulder girdle wanting; the hind limbs and pelvic girdle usually absent (in all of our species), in a few forms the hind limbs rudimentary; vent a transverse slit; tongue forked, capable of protrusion; no movable eyelids, nor external ears. Various anatomical characters distinguish the snakes, but the elongated form

and absence of limbs separate them at once from all our other vertebrates, excepting the lizard *Ophisaurus*, which is in no other respect snake-like.

Families of Serpents

a. Maxillary horizontal, not excavated; no deep pit between eye and nostril; poison fangs wanting, or, if present, permanently erect.
  b. All of the teeth solid, or 1 or 2 of the posterior maxillary teeth grooved. (*Non-venomous* except *Tantilla*) . . . . . COLUBRIDAE, CLXII.
  bb. Upper jaw with permanently erect perforated fangs in front. (*Venomous*). ELAPIDAE, CLXIII.
aa. Maxillary vertical; upper jaws in front with large, erectile perforated fangs; head very broad; a deep pit on each side behind nostril, partly occupying the excavated maxillary. (*Venomous*) . . . . . CROTALIDAE, CLXIV.

FAMILY CLXII. COLUBRIDAE (THE COLUBRINE SNAKES)

Head covered with enlarged scales or shields. Both jaws fully provided with teeth, which are conical and not grooved in our species, except in *Tantilla;* belly covered with broad band-like scales (ventral plates or gastrosteges); tail conical, tapering; subcaudal plates (urosteges) arranged in pairs in our forms.

A very large family, found in nearly every part of the world, but most abundant in warm regions. The species differ from the *Micruridae* in the want of erect, grooved poison fangs in the anterior part of the jaw; from the *Crotalidae* in having both jaws fully provided with teeth, and in the absence of erectile poison fangs. The forms in our region are small, the largest seldom exceeding 6 feet in length, and are mostly terrestrial or semi-aquatic in habits.

a. Keels present on some or all of the dorsal scales of body and tail.
  b. Anal plate divided, or if undivided preocular absent.
    c. Rostral turned up in front and keeled above; internasals separated. HETERODON, 439.
    cc. Rostral normal, not turned up, not keeled above.
      d. Loreal absent. . . . . STOREERIA, 452.
      dd. Loreal present.
        e. One internasal, no preocular.
          f. Upper labials 5; lower labials 6. . . . . POTAMOPHIS, 454.
          ff. Upper labials 7 or 8. . . . . FARANCIA, 437.
        ee. Two internasals; no preocular.
          g. Upper labials 7. . . . . ABASTOR, 436.
          gg. Upper labials 5, 1 postocular. . . . . POTAMOPHIS, 454.
          ggg. Upper labials 6, 2 postoculars. . . . . VIRGINIA, 453.
        eee. Two internasals; 1 or 2 preoculars.
          h. Dorsal scale rows 17.
            i. Tail moderate; caudals fewer than 50. . . . . SEMINATRIX, 451.
            ii. Tail long, caudals more than 50. . . . . OPHEODRYS, 441.
          hh. Dorsal scale rows more than 17, strongly keeled. . . . . NATRIX, 450.
          hhh. Dorsal scale rows more than 17, weakly keeled. . . . . ELAPHE, 444.
  bb. Anal plate undivided; preocular present.
    j. Scale rows ~~29–35~~. 25:29 . . . . . PITUOPHIS, 445.
    jj. Scale rows fewer than ~~29~~. 25
      k. Lower labials 8 or more. . . . . THAMNOPHIS, 456.
      kk. Lower labials 5–7. . . . . TROPIDOCLONION, 455.
aa. Dorsal scales smooth on body and tail.
  l. Anal plate not divided.
    m. Dorsal scale rows decreasing in number posteriorly.
      n. None (rarely a few) of the caudals entire. . . . . LAMPROPELTIS, 447.

mm. Dorsal scales not decreasing in number posteriorly. . . . . CEMOPHORA, 448.
ll. Anal plate divided.
o. Scale rows fewer than 19.
p. Loreal present.
q. No preocular; scale rows 13; upper labials 5. . . . . CARPHOPHIS, 435.
qq. No preocular; scale rows more than 13; upper labials 6. . . VIRGINIA, 453.
qqq. 2 or 3 preoculars, or if 1 the color grass green.
r. Rostral normal.
s. A single anterior temporal; lower preocular of moderate size.
t. Nasal plate divided; color not green; usually a neck-ring. DIADOPHIS, 438.
tt. Nasal plate single; color grass-green; no neck-ring. . LIOPELTIS, 440.
ss. Usually 2 or 3 anterior temporals; lower preocular very small.
u. Scale rows 15 at posterior end of body. . . . . COLUBER, 442.
uu. Scale rows 11 or 13 at posterior end of body. . . MASTICOPHIS, 443.
qqqq. A single preocular; color not green.
v. Scale rows less than 17. . . . . SONORA, 449.
vv. Scale rows 17.
w. Upper labials 7; caudals more than 60. . . . . LEIMADOPHIS, 446.
ww. Upper labials usually 8; caudals fewer than 60. . . SEMINATRIX, 451.
pp. No loreal; scale rows 15; grooved fangs in posterior part of upper jaw. TANTILLA, 457.
oo. Scale rows 19 or more.
x. One or more preoculars. . . . . ELAPHE, 444.
xx. No preocular.
y. A single internasal . . . . . FARANCIA, 437.
yy. 2 internasals. . . . . ABASTOR, 436.

435. CARPHOPHIS Gervais (Gr., *κάρφος*, a dry twig; *ὄφις*, snake)

736. **C. amoena** (Say). GROUND SNAKE. Subsp. **amoena**, glossy chestnut-brown; belly salmon-red; head very small; vertical plate broad; internasals and prefrontals distinct; scales 13. V. P. 120–131. L. 12. Conn. and E. N. Y. to Fla., W. into Appalachians, to Ill. and S. (Lat., pleasing.) Subsp. **helenae** (Kennicott) has the internasals and prefrontals united into 2 large shields between the vertical plate and the nasals. Central Ill. and Ohio, S. to Miss. and Ala. (Lat., a woman's name.) Subsp. **vermis** (Kennicott). WORM SNAKE. Purplish black, belly flesh color, the shade extending on sides; larger than *C. a. amoena*. Mo. and S. E. Neb., S. to Okla., Ark., and La.

436. ABASTOR Gray (A coined name)

737. **A. erythrogrammus** (Daudin). HOOP SNAKE. RAINBOW SNAKE. Blue-black; sides with 3 red lines; belly flesh color, with black blotches; eye very large; nasal plate semi-divided, no preoculars; loreal meeting eye; scales 19. V. P. 166–185. L. 30. Coast region, Va. to Fla. and Ala. A harmless snake concerning which many absurd stories have been told. (Gr., *ἐρυθρός*, red; *γραμμή*, line.)

437. FARANCIA Gray (A coined name)

738. **F. abacura** (Holbrook). HORN SNAKE. MUD SNAKE. Blue-black, with red, squarish spots on side; belly red, blotched with black; eyes small;

scales 19. V. P. 172–196. L. 36. Va. to S. Ind. and S. to Fla. and Tex. (Gr., ἄβαξ, checker; οὐρά, tail.)

438. DIADOPHIS Baird and Girard (Gr., δία, divided; ὄφις, snake)

739. **D. punctatus** (Linnaeus). Subsp. **punctatus.** Ring-necked Snake. Blue-black above, bright pale orange below; ventrals with a black spot on each side and sometimes a median one; belly with a row of semicircular black spots along a median line; a very conspicuous yellowish ring about neck, 2 scales wide, this usually interrupted on median line. Belly with a median series of half-circular black spots. Scales 17. L. 13. Va. to Ala. and Fla. (Lat., with dots.) Subsp. **arnyi** (Kennicott). Belly with black spots scattered or in twos; occipital ring narrow, 1½ scales wide. Scales 17. W. Ill., Iowa, Mo., N. W. Ark. to Great Plains, S. to Tex. (For S. Arny.) Subsp. **edwardsii** (Merrem). Belly usually immaculate, occasionally an imperfect median series of small black spots; neck-ring usually uninterrupted. Scales 17. Wisc. and S. Appalachians, N. to Can. (For George Edwards.) Subsp. **strictogenys** (Cope). Belly spots showing tendency to fuse into a single row or irregularly massed. Scales 15. S. Ill. to Gulf of Mex. (Lat., narrow chin.)

439. HETERODON Beauvais (Gr., ἕτερος, different; ὀδών, tooth)

a. Prefrontals in contact.

740. **H. contortrix** (Linnaeus). Spreading Adder. Puffing Adder. Blowing Viper. Brownish or reddish, with about 20 to 31 dark dorsal blotches besides lateral ones and half rings on the tail; often uniform black, belly generally paler, especially behind. A large up-turned rostral plate. Scales usually 25, sometimes 23. V. P. 123 to 145. L. 28. Mass. to E. Mont., S. to Fla. and Tex. (Lat., one who twists.) When angry it broadens its head and behaves in a very threatening fashion, but is entirely harmless.

aa. Prefrontals separated by small scales.
b. Scale rows 23.

741. **H. nasicus** Baird & Girard. Gray or light brown with 24 to 45 large dorsal, and 2 lateral series of small dark spots; belly largely black. Scales 23. V. P. 126 to 150. L. 27. W. Iowa to Mont., S. to Mex. (Lat., nose.)

bb. Scale rows 25 (27).

742. **H. simus** (Linnaeus). Gray or brown, 22 to 26 large dorsal blotches, and small lateral spots. Belly obscurely checkered with black. Scales 25, rarely 27. V. P. 114 to 132. L. 15. Ind. to N. C. and Fla. (Lat., snub nosed.)

440. LIOPELTIS Fitzinger (Gr., λεῖος, smooth; πέλτη, shield)

743. **L. vernalis** (Harlan). Smooth Green Snake. Grass Snake. Head elongate, neck slender; eyes very large. Uniform bright green (bluish in spirits), yellowish below. Scales 15, smooth. V. P. 128 to 138. L. 16. Nova Scotia to Utah, S. to Pa., Ind., Mo., and Tex. (Lat., spring.)

441. OPHEODRYS Fitzinger (Gr., ὄφις, snake; δρῦς, oak)

744. **O. aestivus** (Linnaeus). Rough Green Snake. Head little distinct from neck; bright green, yellowish below. Scales 17, keeled. V. P. 154 to 163. L. 30. N. J., S. Ohio, cent. Ind. and Mo., and S. E. Kans. to Fla. and Gulf of Mex. (Lat., summer.)

442. COLUBER Linnaeus (*Bascanion* Baird & Girard)
(Lat., a harmless snake)

745. **C. constrictor** (Linnaeus). Subsp. **constrictor.** Black Snake. Lustrous black or very dark gray, greenish below, chin and throat white, young olive with rhomboid black blotches. Body slender, eye very large. Scales 17. V. P. 161 to 193. L. 6 ft. E. U. S., common E. and S., W. to cent. Ind., S. Ill., E. Mo., Ark. and Tex. (Lat., one who squeezes.) Subsp. **flaviventris** (Say), the Blue Racer. Color blue gray or blue green, yellowish below. V. P. 158 to 191. Mich., N. Ohio, Ind., Ill., W. to Rocky Mts., S. in W. Mo., Ark., and Tex. (Lat., yellow belly.)

443. MASTICOPHIS Baird & Girard (Gr., μάστιξ, whip; ὄφις, snake)

746. **M. flagellum** (Shaw). Subsp. **flagellum.** Coach-whip Snake. Body slender, whip-like. Adult more or less uniform brown, paler behind. Young with rhomboid blotches separated by 1 to 2 scales of lighter brown on neck. Scales 17. V. P. 180 to 210. L. 5. Southeast U. S., W. to E. Tex., Okla., and Kans. (Lat., whip.) Subsp. **flavigularis** (Hallowell). Anterior portion of body not darker than posterior in adults. Young with dark blotches which on neck are separated by 3 or more scales of lighter color. V. P. 186 to 207. W. Kans. to Colo., S. to Tex. and Mex. (Lat., yellow-throated.)

444. ELAPHE Fitzinger (*Callopeltis* Bonaparte)
(Gr., ἔλαφος, a deer, the application not evident)

a. Scales smooth, or median dorsals keeled; neck bands of same color as dorsal blotches, meeting on top of head.
b. Ventrals 222 to 241; dorsal blotches 27 to 40.

747. **E. guttata** (Linnaeus). Corn Snake. Reddish brown, with a dorsal series of 27 to 40 large, red, dark-edged blotches; belly checkered. Scales

usually 27. V. P. 222 to 241. L. 50. Va. to Fla., Miss., and La. (Lat., spotted.)

bb. Ventrals 194 to 211; dorsal blotches 31 to 38.

748. **E. vulpina** (Baird & Girard). Fox Snake. Light brown, with 31 to 38 quadrate, chocolate-colored blotches. Scales 25 to 27. V. P. 194 to 211. L. 60. Minn. to Mich. and Ont., S. to Iowa, Ill., and Ind. (Lat., fox-like.)

bbb. Ventrals 211 to 222; dorsal blotches 39 to 48.

749. **E. laeta** (Baird & Girard). Ashy gray with 39 to 48 transverse brown blotches. Scales 29. V. P. 211 to 222. L. 40 to 50. Kans., S. to Mex. (Lat., joyous.)

aa. Scales keeled, except 3 to 11 lateral rows; no neck bands uniting on head.

c. Caudals 63 (female) to 87 (male); with dorsal blotches or unicolor; postocular line wide and continuous.

750. **E. obsoleta** (Say). Subsp. **obsoleta** (Say). Pilot Black Snake. Adult lustrous black, some scales white-edged; belly slaty black; median scales of back obscurely keeled, the rest smooth. Scales generally 25 or 27. V. P. 230 to 245. Young like subsp. *confinis*. Wisc. to Mass., S. through Alleghenies. One of our largest snakes, often climbing trees to a great height by working into depressions in rough bark. (Lat., obsolete, referring to spots.) Subsp. **confinis** (Baird & Girard) is ashy gray, with 30 to 35 dark chocolate blotches on back, their edges faintly darker; 2 smaller series on side; a dark band between eyes; belly blotched. Scales 27 or 29. N. C. to Gulf States, W. to Tex., N. to Ind. (Lat., similar or adjoining.)

cc. Caudals 69 (female) to 97 (male); with 4 longitudinal dorsal lines in adult; postocular line narrow and broken.

751. **E. quadrivittata** (Holbrook). Chicken Snake. Adult greenish yellow, with 2 brownish stripes on each side; straw color below. Young with blotches. Scales usually 27. V. P. 237 to 245. N. C. to Fla. (Lat., 4-striped.)

445. PITUOPHIS Holbrook (Gr., πίτυς, pine tree; ὄφις, snake)

752. **P. melanoleucus** (Daudin). Pine Snake. Whitish with 25 to 35 rows of chestnut-brown blotches which are margined with black, besides 3 series of lateral blotches. Scales 27 to 29. V. P. 220 to 230. L. 72. Pine barrens; N. J., Tenn., and S. A majestic serpent, quite harmless. (Gr., μελάς, black; λευκός, white.)

753. **P. sayi** (Schlegel). Bull Snake. Brownish, 40 to 60 rows of dark orange cross-blotches and spots, sides mottled with black and yellow. Scales 25 to 29. V. P. 220 to 245. L. 8 feet. Minn. to Tex.

446. LEIMADOPHIS Fitzinger (Gr., λειμών, a grassy meadow; ὄφις, snake)

754. **L. flavilatus** (Cope). Golden brown; a dark line from rostral through eye to last labial. Belly yellowish white. Scales 17. V. P. 126. L. 24. N. C. to Fla. and Miss.

447. LAMPROPELTIS Fitzinger (Gr., λαμπρός, shining; πέλτη, shield)

a. Color pattern without red, and without dorsal blotches of brown or gray with black borders.

755. **L. getulus** (Linnaeus). Subsp. **getulus.** Chain Snake. Thunder Snake. Black with fewer than 50 narrow yellowish lines forking on the flanks, each fork embracing a large black spot, belly checkered. Scales usually 21, sometimes 23. V. P. 203 to 224. N. J. to Fla. and Ala. Subsp. **holbrookii** (Stejneger). Blue black with an oval white, yellow, or greenish spot on each scale. Scales 21, occasionally 23, rarely 19. V. P. 200 to 220. L. 57. Ill. to E. Tex., W. to Wy. Subsp. **nigra** (Yarrow). Black, scales without light spots; 50 to 90 narrow cross-bands, tending to fork on sides and joining an alternating series of short transverse bands. Scales 21. V. P. 199 to 217. L. 57. E. Ill. and Ohio, S. to cent. Ala. (Lat., black.)

aa. Pattern of black-edged dorsal blotches of brown or red, only narrowly in contact with 5th row of scales or only to 6th or 7th rows.
b. Scale rows 23 or 21.

756. **L. rhombomaculata** (Holbrook). Brown King Snake. Light or dark brown or greenish, lighter on sides; 48 to 64 elongate dark brown or reddish dorsal blotches margined with black; two series of alternating lateral spots commonly fused. Belly white or yellowish checkered with black. Scales 21 or 23. V. P. 191 to 213. L. 46. Md. and Tenn., S. to Fla. and Ala. (Lat., with rhomboid spots.)

bb. Scale rows 25 or 27.

757. **L. calligaster** (Harlan). Light olive gray, with 46 to 78 quadrate brownish or greenish double concave blotches on back and 2 rows of smaller ones on each side. Belly with small quadrate brownish or yellowish blotches or mostly immaculate. Scales 25 or 27. V. P. 196 to 215. L. 54. Minn. and Ind., S. to Tex. and Miss. (Gr., κάλλις, beauty; γαστήρ, belly.)

aaa. Pattern in rings, or if in blotches these broadly in contact with 5th row.
c. Scale rows usually 21, rarely 19 or 23; usually 2 anterior temporals.

758. **L. triangulum** (Lacépède). Subsp. **triangulum.** Milk Snake. Spotted Adder. Grayish with 45 to 60 squarish brown blotches bordered with black, and an alternating series of smaller spots on each side; an arrow-shaped mark of ground color on occiput. Belly white, sometimes suffused with red, with small quadrate black spots. Scales usually 21. V. P. 180 to 213. L. 44. E. U. S. and S. Can. Subsp. **syspila** (Cope). Dorsal blotches generally red; 23 to 36 whitish cross-bands between blotches; a whitish half-

collar. Scales 21, often 23. V. P. 180 to 215. L. 43. S. Ind. to Minn., S. to Ark. and cent. Kan. (Gr., *σύν*, together; *σπίλος*, spot.) Subsp. **gentilis** (Baird & Girard). 25 to 40 light gray to yellow rings, separating pairs of black rings themselves separated by brown or red. Scales usually 21. V. P. 176 to 212. L. 30. S. D. to Tex., W. to Utah and Ariz. (Lat., belonging to the same gens.)

cc. Scale rows usually 19 or 17, usually 2 anterior temporals.

759. **L. elapsoides** (Holbrook). Subsp. **elapsoides.** Scarlet King Snake. 15 to 25 complete black rings, bordering narrow yellow rings and separated by broader red rings. Scales usually 19. V. P. 152 to 193. L. 24. N. C. and Kans. to Fla. and La. (*Elaps*, the coral snake, now called by the older name *Micrurus*.) Subsp. **virginiana** Blanchard. Red areas, not continuous across belly but restricted to black-bordered dorsal saddles that extend to belly. Del. to N. C. (Lat., of Virginia.)

448. CEMOPHORA Cope (Gr., *κημός*, muzzle; *φορός*, bearing)

760. **C. coccinea** (Blumenbach). Crimson, with 20 to 26 black rings enclosing yellow ones; top of head red or orange. Belly yellowish. Scales 19. L. 17. V. P. 169 to 170. Md. to S. Tenn., S. to Fla. and La. (Lat., crimson.)

449. SONORA Baird & Girard (after the Mexican state of Sonora)

761. **S. semiannulata** Baird & Girard. Brown above, sometimes with a median dorsal light line, or pinkish with 17 to 40 black cross-bands. Belly greenish white. Scales 15. V. P. 145 to 167. L. 20. Kans. to Nev., S. to Mex. (Lat., half-ringed.)

450. NATRIX Laurenti (Water Snakes) (*Tropidonotus* Kuhl) (Lat., from *nato*, to swim)

a. Scale rows 19.

b. Lower labials 7; 1 preocular; nasal half divided.

762. **N. kirtlandi** (Kennicott). Light reddish brown, with 4 series of round black spots; belly reddish with a row of black spots on each side; head shining black; head small, little distinct from neck. V. P. 129 to 133. L. 16. W. Pa. and Mich. to N. E. and cent. Ill., S. through Ohio and Ind. (To Dr. Jared P. Kirtland.)

bb. Lower labials 9–11; usually 2 preoculars; nasal divided.

763. **N. rigida** (Say). Striped Water Snake. Greenish brown; 2 brown dorsal bands; a brown spot at base of each scale on side; no yellow lateral band; belly yellowish, with 2 rows of elongate dark spots in the middle. V. P. 132 to 147. L. 24. S. C. to Fla. and La. (Lat., stiff, rigid.)

764. **N. septemvittata** (Say). Moon Snake. Queen Snake. Chestnut-brown; a yellow lateral band and 3 narrow black dorsal stripes; belly yellow, with 2 subcontinuous brown bands in the middle. V. P. 141 to 151. L. 24. Pa. to Wisc., S. to Ala. (Lat. 7-lined.)

765. **N. grahami** (Baird & Girard). Brown; a pale brown dorsal band bordered by two narrow black streaks on each side; a straw-colored lateral stripe; belly with one median stripe or no markings except on end of ventrals. V. P. 129 to 133. L. 20. Ill., W. to Kans., S. to La. and Tex. (To Col. J. D. Graham.)

aa. Scales in 23 to 25 rows (rarely 27).
c. Ventrals 135 to 155.

766. **N. sipedon** (Linnaeus). Subsp. **sipedon**. Water Snake. "Moccasin." Brownish, back and sides each with a series of large, square, dark blotches alternating with each other; rarely uniform brownish; no light line from eye to angle of mouth; belly usually with black-edged half circles. Scales usually 23. V. P. 135 to 155. L. 30 to 50. S. Me. to Minn. and Colo., S. to Ala. and Okla. Very abundant about streams and ponds, feeding on fishes and frogs. Variable; an unpleasant and ill-tempered, but harmless snake. (Gr., *σείπηδον*, a siren.) Subsp. **erythrogaster** (Shaw), the Copper Belly. Red-black above, unspotted; belly uniform light or reddish below. Va. and the Carolinas, W. to La., N. in Miss. Valley to S. Ill. (Gr., *ἐρυθρός*, red; *γαστήρ*, belly.)

cc. Ventrals 123 to 135.

767. **N. fasciata** (Linnaeus). Subsp. **confluens** Blanchard. Brown, with 11–17 transverse black blotches on back and about 35 oblong red spots on sides; a light line from eye to angle of mouth; belly reddish, usually blotched. Scales 25. V. P. 123 to 135. S. E. Mo. to La., Ark., and Tex., swarming in the lowland swamps S. (Lat., flowing together, referring to markings.)

aaa. Scales in 27 to 33 rows.
d. Eye separated from labials by subocular.

768. **N. cyclopion** (Duméril & Bibron). Plumbeous, with alternating blackish vertical bars 1 to 1½ scales wide; 2 series of small lateral spots. Dorsal blotches usually 29 to 31 (occasionally 27). V. P. 132 to 150. Scales 27 to 33. S. Ill. to Fla. and La. (Diminutive of Gr., *κυκλόω*, round-eyed.)

dd. Eye in contact with labials.

769. **N. rhombifer** (Hallowell). Brown with 26 to 33 black quadrangular blotches bordered by black lines; a single series of lateral spots. Scales usually 27, occasionally 25, 29, or 31. V. P. 136 to 150. Ill. and Ind., S. to Fla. and Mex. (Lat., bearing diamond-shaped spots.)

451. SEMINATRIX Cope (Lat., half natrix)

770. **S. pygaea** (Cope). Dark brown or black above, with a faint pale line on each scale; no line from rostral to last labial. Belly red, crossed with narrow black bars. Scales 17. V. P. 120 to 133. L. 13. N. C. to Fla. (Gr., πυγή, rump.)

452. STORERIA Baird & Girard (To Dr. David Humphreys Storer)

771. **S. occipitomaculata** (Storer). Red-bellied Snake. Grayish or chestnut brown, usually with a paler vertebral stripe bordered by dark dots; obscure dots on side; occiput with 3 pale blotches (a very constant feature); belly salmon red; scales 15. V. P. 116–133. L. 12. Me. to Wisc., Iowa, and east. Kans., S. to Ala., Ga., and Fla., in wet places. (Lat., with occipital spots.)

772. **S. dekayi** (Holbrook). Brown Snake. Grayish brown; clay-colored dorsal stripe, bordered by dotted lines; grayish below; a dark patch on each side of the occiput; scales 17. V. P. 120 to 138. L. 12. Me. to Minn. and cent. Kans., S. to Fla. and Mex. (To James Ellsworth DeKay.)

453. VIRGINIA Baird & Girard

773. **V. valeriae** Baird & Girard. Subsp. **valeriae** (Baird & Girard). Grayish, with minute black dots, often in 2 rows; yellowish beneath; scales 15, few or nonekee led. V. P. 112–128. L. 12. N. J. and S. Ohio, S. to S. C. and Tenn., Ohio and S. (To Valeria Blaney.) Subsp. **elegans** (Kennicott). Olivaceous above, yellowish beneath; scales 17, usually keeled. S. Ind. to E. Ill., S. to Gulf, W. to cent. Tex. (Lat., elegant.)

454. POTAMOPHIS Fitzinger (*Haldea* Baird & Girard)
(Gr., ποταμός, river; ὄφις, snake)

774. **P. striatulus** (Linnaeus). Brown Snake. Head somewhat elongated, on a slim neck; one internasal; eye large. Reddish gray, salmon red beneath; without spots, scales 17; V. P. 114–135. L. 10. Va. and cent. Mo., S. to Fla. and Tex. (Lat., narrowly striped.)

455. TROPIDOCLONION Cope. (Gr., τροπίς, keel; κλωνίον, twig)

775. **T. lineatum** (Hallowell). Streaked Snake. Color drab above with a light vertebral line bordered on each side by a series of black spots; a similar lateral stripe on 2d and 3d scale rows; underneath pale, with 2 series of black spots along middle of belly. V. P. 138–150. L. 12. Southern Ohio, Iowa, and W. Kans., S. to Gulf of Mex. (Lat., lined.)

456. THAMNOPHIS Fitzinger (Garter Snakes. Ribbon Snakes)
(*Eutainia* Baird & Girard) (Gr., θάμνος, thicket; ὄφις, snake)

a. Lateral stripe anteriorly upon 3d and 4th rows of scales.
b. Tail generally more than 0.27 of total length; body slender.

Ribbon Snake

776. **T. sauritus** (Linnaeus). Subsp. **sauritus.** Upper labials usually 7. Greenish brown, with 3 yellow stripes; sides brown; colors bright. V. P. 150 to 172. L. 36. Mich., Ont., and Me., S. to Ala. and Ga., about clear streams and ponds. A most graceful snake. (Lat., lizard-like.) Subsp. **proximus.** Upper labials usually 8. V. P. 150–179. L. 36. Wisc. to Neb., S. to Cent. Am. (Lat., very near.)

bb. Tail generally less than 0.27 of total length; body stouter.

777. **T. radix** (Baird & Girard). Subsp. **radix.** Dorsal scale rows generally 19–21–19–17, sometimes 21–19–17, upper labials 7 or 8. Brown, with 3 narrow stripes, the dorsal yellow, the lateral greenish or bluish. V. P. 142 to 176. L. 25. Minn. to Alberta, E. to S. Wisc. and W. Ind., S. to Okla. and Mo. (Lat., root, from Root River.) Subsp. **butleri** (Cope). Dorsal scale rows 19–17 or less; upper labials 6 or 7. Lateral stripe anteriorly on 2d, 3d and 4th rows, posteriorly on 2d and 3d. V. P. 132-154. L. 12. S. Mich. to S. Ind., E. to W. Pa. (To Amos William Butler.)

aa. Lateral stripe not involving 4th row of scales, anteriorly on the 2d and 3d rows.

778. **T. sirtalis** (Linnaeus). Garter Snake. Subsp. **sirtalis.** Dorsal scale rows 19–17. Olivaceous to black, with 3 light stripes (occasionally wanting); 2 distinct rows of black spots on the skin between the stripes. V. P. 137–167. L. 25. E. U. S. and Can., N. to 52°, W. to Minn., Mo., and La. (Lat., like a garter.) The chief of many variants is subsp. **parietalis** (Say), with the stripes generally dull greenish and the upper row of black spots fused, and the spaces between the spots of the 2d row more or less vivid brick red. Minn., Iowa, and Mo., W. to east. Wash., to Pacific Coast in California. (Lat., pertaining to the parietal region.)

457. TANTILLA Baird & Girard (Name unexplained)

a. A light neck-band bordered behind by a black band.

779. **T. coronata** Baird & Girard. Reddish brown; head dark brown or black; a pale neck-band, separated from parietals by 3 or 4 scales. Upper labials 7; postoculars 2. Scales 15. V. P. 130 to 143. L. 9. Cent. and W. Tenn., S. and E. (Lat., crowned.)

aa. No light neck-band.
b. Upper labials 6; usually 1 postocular.

780. **T. gracilis** (Baird & Girard). Greenish brown; head brown but little darker than body; no light neck-band. Upper labials 6; usually 1 postocular. Scales 15. V. P. 111 to 133. L. 6. Cent. Mo. and E. Kans., S. to Tex. (Lat., slender.)

bb. Upper labials 7, 2 postoculars.

781. **T. nigriceps** (Kennicott). Pale brownish, head black, this color encroaching upon 1 to 4 dorsal scales; no light neck-band; upper labials 7, 2 postoculars. Scales 15. V. P. 136 to 161. L. 12. Kans., W. to Utah, S. to Mex. (Lat., black-headed.)

Family CLXIII. ELAPIDAE

(The Harlequin Snakes or Coralillos)

Venomous snakes, provided with 2 or more permanently erect, perforated fangs in the front of the upper jaw, with usually a series of smaller teeth behind them; scales not keeled, in 15 rows; no loreal plate. Anal plate entire or divided. Species few, chiefly East Indian, a few in a single genus inhabiting warmer parts of America.

458. MICRURUS Wagler (*Elaps* Schneider)

(Gr., μικρός, small; οὐρά, tail)

782. **M. fulvius** (Linnaeus). Coralillo. Bead Snake. Coral Snake. Red, black, and yellow, arranged in rings; about 14 broad red rings usually spotted with black, separated from broad black rings by narrow yellow ones; tail ringed with black and yellow. Scales 15. V. P. 200 to 215. L. 34. East. N. C. and southeast. Mo. to Fla. and Mex. A beautiful but often deadly snake. (Lat., reddish yellow.)

Family CLXIV. CROTALIDAE (The Pit Vipers)

Maxillary vertical, without solid teeth, but provided with a long, erectile, perforated poison-fang on each side in front; a deep pit between eye and nostril, extending into the excavated maxillary. Body stout; head large, flat, triangular; pupil elliptical, placed vertically. Tail usually provided with a rattle composed of horny rings, which are modified scales. Subcaudal plates generally undivided, at least anteriorly. Scales keeled, in all our species; anal plate entire. Species about 60, renowned for their venom. All are viviparous.

a. Tail short, without rattle, ending in a horny point; top of head with about 9 symmetrical plates. . . . . Agkistrodon, 459.

aa. Tail with a rattle.

b. Top of head with about 9 plates symmetrically arranged; rattle small. Sistrurus, 460.

bb. Top of head covered with small scales; rattle large. . . . . Crotalus, 461.

459. AGKISTRODON Beauvais (Gr., ἄγκιστρον, hook; ὀδών, tooth)

a. Loreal plate present. (*Agkistrodon.*)

783. **A. mokasen** Beauvais (Linnaeus). COPPERHEAD. Hazel brown; top of head coppery red; back with a series of 15 to 25 pairs of V-shaped blotches, meeting on mid-dorsal line; belly yellowish, with 35 to 45 dark spots on each side; loreal plate present. Scales 23. V. P. 145 to 155. L. 40. South. N. H. to cent. Ill. and cent. Kans., S. to Fla. and Tex. A dangerous reptile. (From *moccasin*, a native name.)

aa. Loreal plate wanting. (*Toxicophis.*)

784. **A. piscivorus** (Holbrook). WATER MOCCASIN. COTTON-MOUTH. BLACK MOCCASIN. Greenish brown, with 20 to 30 dark vertical bars, often obscure; belly black and yellow, blotched. Loreal absent. Scales 21 to 25. V. P. 130 to 147. L. 47. S. E. Va. to Fla., and S. Ill. and Mo. to Tex. and the Gulf. Aquatic, often resting on overhanging bushes over streams, watching for frogs and fishes. The most dangerous of our snakes. (Lat., fish-eating.)

460. SISTRURUS Garman (Gr., σεῖστρον, rattle; οὐρά, tail)

a. Prefrontals not in contact with loreal; light stripe on head from posterior nasal to angle of mouth.

785. **S. catenatus** (Rafinesque). Subsp. **catenatus.** PRAIRIE RATTLESNAKE. MASSASAUGA. Dark gray or yellowish brown; a dorsal series of about 24 large transversely elliptic or reniform chestnut-colored blotches with black borders exteriorly edged with yellow; lateral spots smaller. Belly blackish brown and yellow. Scales usually 25. V. P. 137 to 143. L. 33. Ont., W. N. Y., and Mich. to Kans. (Lat., chain-like, from the markings.) Subsp. **edwardsii** (Baird and Girard). Yellowish brown; about 34 large irregular dorsal blotches, edged with black and margined with yellow; smaller lateral spots present. Belly yellowish, dotted irregularly with brown. Scales 23. V. P. 136 to 147. L. 26. W. Kans. to Tex. and Ariz. (Lat., to Dr. L. E. Edwards.)

aa. Prefrontals in contact with loreal; light stripe on head from below eye to angle of mouth.

786. **S. miliarius** (Linnaeus). PIGMY RATTLESNAKE. Grayish, yellowish, or brown; 1 or 2 dorsal series of large, black-edged blotches, or transverse series of crossbars; vertebral line often orange. Belly whitish, speckled and spotted with brown or black. Scales 21 or 23. V. P. 127 to 139. L. 21. N. C. to Fla., and S. Mo. to Ark., E. Tex., and the Gulf of Mex. (Lat., of millet.)

461. CROTALUS Linnaeus (Gr., κρόταλον, a rattle)

a. Dorsal pattern of dark chevron bands.

787. **C. horridus** (Linnaeus). Common Rattlesnake. Timber Rattler. Canebrake Rattler. Light yellowish and light reddish gray to brown or black; 21 large dorsal blotches, anteriorly chevron-shaped, posteriorly usually fused with lateral spots to form zig-zag bands; tail black in adults, banded in young; posterior half of body entirely black in some localities. Scales 23 to 25. V. P. 167 to 178. L. 54. Me. to Wisc. and Great Plains, S. to Ga. (Lat., dreadful.)

> I only know thee, humble, bold,
> Haughty, with miseries untold,
> And the old curse that left thee cold,
> And drove thee ever to the sun
> On blistering rocks. . . . .
> Thou, whose fame
> Searchest the grass with tongue of flame,
> Making all creatures seem thy game,
> When the whole woods before thee run,
> Asked but — when all is said and done —
> To lie, untrodden, in the sun!
>
> Bret Harte

bb. Light line on temporal region, reaching or failing to reach 2d scale row above angle of mouth.

788. **C. confluentus** Say. Prairie Rattlesnake. Yellowish brown; a dorsal series of 27 to 29 subquadrate dark blotches narrowly margined with yellow and becoming half-rings posteriorly; two rows of poorly defined lateral spots; tail cross-banded. Belly dull yellowish. Scales 25 to 29. V. P. 168 to 197. L. 60. Can. to Tex., on Great Plains between 96th meridian and the Rockies. (Lat., flowing together.)

bbb. Light line on temporal region reaching 2d scale row above mouth at least 2 scales anterior to angle of mouth.

789. **C. adamanteus** Beauvais. Diamond Rattlesnake. Yellowish gray with a median series of large rhomboidal dark spots, and a series of small rhomboidal spots on each side; 3 or 4 dark rings on tail. Scales 27. V. P. 165 to 180. L. 8 feet. South. N. C. to Fla. and La. (Lat., diamond-like.)

Order XL. TESTUDINATA (The Turtles)

Reptiles with the body enclosed between 2 more or less developed bony shields, which are usually covered by horny epidermal plates, but sometimes by leathery skin. Upper shield (carapace) and lower shield (plastron) more or less united along the sides. Neck and tail the only flexible part of the spinal column; these, together with the legs, usually retractile within the two shields. The bony part of the carapace formed by the dorsal and sacral vertebrae,

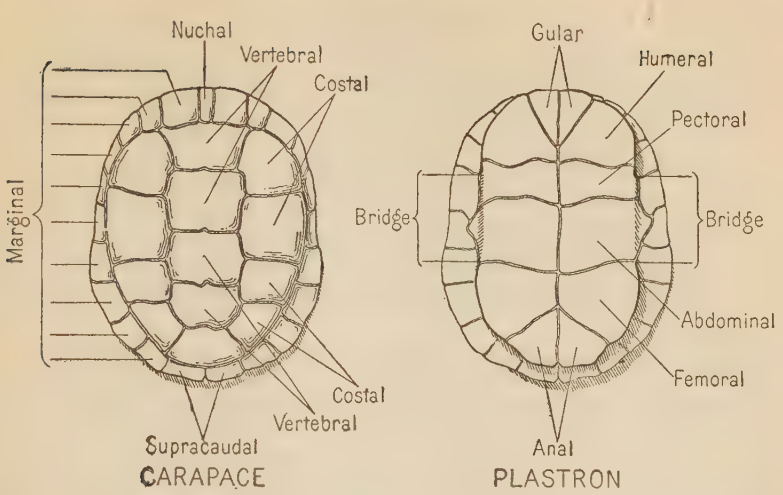


Fig. 6. Upper and lower shields (carapace and plastron) of the species in the order *Testudinata* (Turtles), showing the positions of the epidermal plates.

and the ribs coössified with a series of overlying bony plates, usually accompanied by a marginal row. The dorsal vertebrae have their ends flattened and are immovably united by cartilage, and all of them except the first and last, have their neural spines flattened horizontally so as to form the median line of plates. On either side of this series is a single row of ossified dermal plates overlying the ribs and corresponding in number to the developed ribs, of which there are usually 8 pairs. No true sternum; plastron consisting of membrane bones, of which there are usually 9 pieces — 4 pairs and a single symmetrical median piece. The osseous plates, both above and below, correspond neither in number nor position with the overlying dermal plates.

The skull is more compact than that of other reptiles. There are no teeth, but the jaws are encased in horny sheaths, usually with sharp cutting edges; the eye is furnished with two lids and a nictitating membrane, as in birds; the tympanic membrane is always present, although sometimes hidden by the skin. Respiration is effected by swallowing air. (Lat., *testudo*, tortoise.)

Suborder CRYPTODIRA

Neck retractile in the vertical plane; carapace with peripheral plates, and covered with scales. Sea, fresh-water, and land turtles.

Families of Cryptodira

a. Limbs developed as paddles, not capable of distinct movements at wrist or ankle; digits flattened, elongated, bound immovably together by the integument. (Sea Turtles.)
b. Feet scaleless, the anterior very large. . . . . Dermochelidae, CLXIX.
bb. Feet scaly; carapace heart-shaped. . . . . Cheloniidae, CLXVIII.
aa. Limbs not in the form of paddles, capable of movement at wrist and ankle joints. (Land and pond turtles.)
c. Tail very long and strong, with a crest of tubercles; plastron narrow and small, cross-shaped, with 9 plates (besides the bridge); head large; body highest in front. Chelydridae, CLXVI.
cc. Tail short, not crested; plastron broad.
d. Lower jaw ending in a long sharp point; carapace highest behind the middle, its edge not flaring outward; plastron with 9 to 11 plates. Kinosternidae, CLXV.
dd. Lower jaw without long point at symphysis; carapace highest at about the middle, its edge flaring outward; plastron with 12 dermal plates. Testudinidae, CLXVII.

Family CLXV. KINOSTERNIDAE (The Box Turtles)

Carapace rather long and narrow, the outline usually rising gradually from the front to a point beyond the center of the shell, backward; margin of the carapace turning downward and inward rather than outward; plastron proportionally large, covered with 9 to 11 horny plates, the anterior pair coalescing into one; anterior lobe, and sometimes also posterior lobe, of plastron often movable upon the fixed central portion; head pointed; jaws usually strong; eyes far forward; limbs slender; feet short.

a. Plastron with its anterior and posterior lobes nearly equal in length, both freely movable and capable of closing the shell; posterior lobe emarginate behind, its angles rounded; carapace without traces of keel in adult. . . . . Kinosternon, 463.
aa. Plastron with its posterior lobe longer than anterior, truncate behind, its posterior angles not rounded; lobes of plastron little movable, incapable of closing the shell; carapace more or less keeled, at least when young; head very large, with strong jaws. Sternotherus, 462

462. STERNOTHERUS Gray (Gr., *στέρνον*, sternum; *θαιρός*, hinge)

790. **S. odoratus** (Latreille). Musk Turtle. Stinkpot. Shell dusky, clouded, sometimes spotted; neck with 2 yellow stripes, one from above eye, the other from below; head very large, with strong jaws; carapace with traces of a dorsal keel, but only occasionally of lateral keels, the plates not imbricated, in the adult; no point at symphysis of upper jaw; odor strongly musky. L. 6. E. U. S., abundant, W. to Mo. and S. Tex. (Lat., emitting an odor.)

790*a*. **S. minor** (Agassiz). No yellow lines on head; plates of shell more or less overlapping; sides usually with a sharp keel. Tenn., Fla., Ga., and Ala. (Lat., lesser.)

463. KINOSTERNON Spix (Gr., *κινέω*, to move; *στέρνον*, breast)

791. **K. subrubrum** (Lacépède). Subsp. **subrubrum**. Mud Turtle. Shell dusky brown; head dark, with light dots. L. 4. E. U. S. to S. E. Ill.,

S. to Fla. (Lat., nearly red.) Subsp. **hippocrepis** (Gray). 2 orange bands on side of head. S. E. Mo. to Ala. and Tex. (Gr., ἵππος, horse; κρηπίς, shoe.)

791*a*. **K. flavescens** (Agassiz). Yellowish brown or greenish yellow; sides of head and neck yellow. Kans. to Tex., Colo., and Ariz. (Lat., turning yellow.)

Family CLXVI. CHELYDRIDAE (The Snapping Turtles)

Shell high in front, low behind; body heaviest forward; head and neck very large, the snout narrowed forward; jaws strongly hooked, and very powerful; tail long, strong, with a crest of horny, compressed tubercles; plastron small, cross-shaped, with 9 plates besides the very narrow bridge. Claws 5–4, strong, the web small. Large turtles of great strength and voracity, chiefly aquatic.

a. Head covered with soft skin; tail with 2 rows of moderate scales beneath; ridges of carapace becoming obsolete with age; jaws moderately hooked. . . Chelydra, 465.
aa. Head very large, covered with smooth, symmetrical plates; tail with many small imbricate scales beneath; carapace with 3 large persistent keels; jaws very strongly hooked. . . . . Macrochelys, 464.

464. MACROCHELYS Gray (Gr., μακρός, large; χέλυς, turtle)

792. **M. temminckii** (Hallowell). Alligator Snapper. Blackish, pale brown, or yellowish; head very large and covered with plates. L. 40. Attains weight of 120 lb. N. Mo. to Tex. and Fla. (To C. J. Temminck.)

465. CHELYDRA Schweigger (Gr., χέλυς, turtle; ὕδωρ, water)

793. **C. serpentina** (Linnaeus). Common Snapping Turtle. Dusky brown; head with dark spots. L. 25 or more. E. U. S. to Rockies; Can. to Gulf of Mex. (Lat., like a serpent, referring to head and neck.)

Family CLXVII. TESTUDINIDAE (The Pond and Land Turtles)

Carapace ovate, broadest behind, the margin having a tendency to flare outward, highest near the middle and usually not strongly convex, a few species with higher and more rounded carapace; plastron covering the whole under surface, its plates 12 in number; sometimes the anterior lobe (and rarely the posterior also) movable on a transverse hinge, enabling the animal to close the shell completely. Toes broadly webbed in the aquatic species; scarcely webbed in the others. The pond turtles feed largely upon animals, but they rarely catch active prey. Most of them will not bite except under much provocation. Species widely distributed, inhabiting marshes, ponds, and the shores of still streams; a few are strictly terrestrial.

a. Plastron without hinge, immovably joined to carapace.
b. Alveolar surface of jaws broad; carapace depressed; toes short, broadly webbed.

c. Alveolar surface of jaws smooth, a deep groove in front; upper jaw not notched in front; head covered with soft skin; carapace more or less keeled.
d. Lower jaw with a spoon-shaped dilation at tip. . . . . GRAPTEMYS, 470.
dd. Lower jaw without spoon-shaped dilation at tip, the cutting edges smooth. MALACLEMYS, 469.
cc. Alveolar surface of upper jaw divided by a longitudinal ridge parallel to margin; upper jaw notched in front; head with thin hard skin; carapace scarcely keeled. PSEUDEMYS, 472.
bb. Alveolar surface of jaws narrow.
e. Carapace depressed (never keeled); toes strong, broadly webbed, the hind feet largest; alveolar groove of jaws well marked, except in front; upper jaw notched in front.
f. Marginal shields with red markings. . . . . CHRYSEMYS, 471.
ff. Marginal shields without red markings. . . . . DEIROCHELYS, 473.
ee. Carapace considerably arched; feet subequal, the toes narrowly webbed. CLEMMYS, 466.
aa. Plastron with a movable transverse hinge across its middle; a movable cartilaginous lateral suture uniting plastron with carapace.
g. Body depressed; plastron emarginate behind; toes well webbed. . . . EMYS, 467.
gg. Body short and high; plastron rounded or truncate behind; toes scarcely webbed; not aquatic. . . . . TERRAPENE, 468.

466. CLEMMYS Wagler (Gr., κλέμμυς, tortoise)

a. Carapace usually more or less keeled; upper jaw deeply notched and arched downward.

794. **C. muhlenbergii** (Schöpff). Brown, with yellowish markings; plastron black, with yellowish blotches; head black, with a large orange-yellow blotch on each temple; plates of back plain or concentrically grooved. L. 4½. E. Pa. and R. I., S. to N. C. (For G. H. E. Muhlenberg.)

795. **C. insculpta** (Le Conte). WOOD TORTOISE. Shell carinated, each plate marked with concentric striae and narrow radiating yellow lines and spots; head and feet blackish, the other soft parts reddish brown or gray; plastron with a black blotch on each plate. L. 8. E. U. S., W. to Mich. and Wisc. (Lat., engraved.)

aa. Carapace not keeled; upper jaw slightly notched, its edge nearly straight.

796. **C. guttata** (Schneider). SPECKLED TORTOISE. Black, with round orange spots, these spots rarely obsolete; plastron yellow, blotched with black. L. 4½. Me. to S. Mich., S. to Fla. (Lat., spotted.)

467. EMYS Duméril (Gr., ἐμύς, turtle)

797. **E. blandingii** (Holbrook). Black, usually with numerous and irregular small yellowish spots; plastron yellowish, with black blotches; head with yellow spots; throat bright yellow; young black, nearly circular. L. 8. Minn. to New Eng., S. to Iowa and Ill.

468. TERRAPENE Merrem (Of Am. Indian origin)

798. **T. carolina** (Linnaeus). Subsp. **carolina.** COMMON BOX TURTLE. Young keeled, the keel growing obscure with age. Colors very variable,

chiefly blackish and yellowish; rarely 2 alike in pattern; iris red in ♂; hind feet with 4 toes. Me. to S. Mich., S. to Ga. Represented S. by subsp. **triunguis** (Agassiz). Hind feet mostly 3-toed; color dull olive, with obscure yellowish markings. Mo. and Okla. to Gulf of Mex.

799. **T. ornata** (Agassiz). No trace of dorsal keel. Carapace dark brown or black, with rather broad radiating yellow lines; hind feet with 4 toes. Ind. and Ill. to the Rockies, and from Mont. to Mex.

469. MALACLEMYS Gray (Gr., μαλακός, soft; κλέμμυς, tortoise)

800. **M. centrata** (Latreille). Subsp. **centrata**. Salt-marsh Turtle. Diamond-back. Greenish or dark olive, rarely black; plates, both of carapace and plastron, usually with concentric dark stripes; shell smooth or with concentric grooves. Cape Hatteras to Fla., on the coast. (Lat., pertaining to the center.) Subsp. **concentrica** (Shaw). Maryland Terrapin. Concentric lines plainer. The coast form, abundant about Buzzards Bay, Delaware Bay, and Chesapeake Bay; S. to Fla. Valued by epicures. (Lat., with common center.)

470. GRAPTEMYS Agassiz (Gr., γραπτός, engraved; ἐμύς, turtle)

801. **G. geographica** (Le Sueur). Map Turtle. Dark olive, with greenish and yellow streaks and reticulations, especially distinct on neck, legs, and edges of carapace; a triangular spot back of eye; plastron yellowish; carapace strongly notched behind and usually decidedly keeled, keel not serrate. Mich. to N. Y. and Iowa, S. to Okla., N. E. Tex., and Mo. (Lat., geographic, from resemblance of markings to a map.)

802. **G. pseudogeographica** (Gray). Subsp. **pseudogeographica**. Similar but grayer, the markings on the shell paler, less distinct and in larger patterns; keel of carapace stronger, each plate of the vertebral series with a blackish projection behind, which is more or less imbricated over the succeeding plate; plastron yellowish, marbled with dark; head, neck, and legs with bright yellow stripes, a light crescent back of the eye. Wisc., N. Iowa, and W. Kans., S. to Ala.

471. CHRYSEMYS Gray (Gr., χρυσός, gold; ἐμύς, turtle)

803. **C. picta** (Schneider). Painted Turtle. Mud Turtle. Vertical scales nearly opposite the lateral scales. Greenish black; plates margined with paler; marginal plates marked with bright red; plastron yellow, often blotched with brown. L. 8. East. U. S., S. to Ga. One of the most common turtles. (Lat., painted.)

804. **C. bellii** (Gray). Carapace dark olive, plates with very narrow or no yellow margin but with faint yellow reticulations; plastron yellow, with a large

black marking. N. Mich., Minn., and Dakotas to Brit. Col., S. on Grt. Plains to Mex. Subsp. **dorsalis** (Agassiz). Carapace with a yellow dorsal stripe; plastron plain yellow. S. Mo., S. in Miss. Valley. Subsp. **treleasei** (Hurter). Dorsal shields with narrow yellow borders; plastron blood-red with an obsolete dark patch. S. W. Ill. (To William Trelease, botanist.) Subsp. **marginata** (Agassiz). Plates of carapace alternating or in quincunx, the lateral rows out of line with the middle one, instead of forming sets of 3 as in *C. picta;* lateral plates with strong concentric striae. Carapace dark olive, shields with narrow yellow margins; plastron yellow with a long black spot in center. W. N. Y. and S. Mich. to Miss. River.

472. PSEUDEMYS Gray (Sliders. Cooters)

(Gr., *ψευδής*, false; *ἐμύς*, turtle)

a. Carapace smooth; head very small.
b. Posterior border of carapace scarcely serrated.

805. **P. troosti** (Holbrook). Yellow-bellied Terrapin. Carapace greenish black with large black blotches; marginal plates beneath and plastron yellow, with black blotches; head dull olive without markings. Edges of both jaws smooth. L. 8. N. Mo. and S. Ind., S. in Miss. Valley. (To Gerard Troost, an early geologist.)

bb. Posterior border of carapace serrated.

806. **P. hieroglyphica** (Holbrook). Carapace olive brown, variously marked with reticulated or concentric yellowish lines; plastron yellowish; head and neck with yellow lines. Edges of both jaws smooth. S. from Tenn. (Lat., with hieroglyphics.)

aa. Carapace wrinkled, particularly along the sides; head moderate or large.
c. Both jaws smooth.

807. **P. elegans** (Wied). Brown, with yellowish wavy lines and blotches; head and neck with yellow lines, an elongated red spot behind eye; plastron yellow with a dusky blotch on each plate. Ind. to Iowa and Texas. (Lat., elegant.)

808. **P. concinna** (Le Conte). Brown or olive, with numerous black-edged yellow bands; head black with red or yellow stripes; plastron yellow. S. Md. to Ga. (Lat., beautiful, striking.)

ccc. Both jaws serrated.

809. **P. rubriventris** (Le Conte). Red-bellied Terrapin. Carapace dusky, with irregular red markings above; marginal plates with much red; plastron red or partly yellowish; head and neck brown, with reddish lines; variable. N. J. to Fla. (Lat., red-belly.)

810. **P. texana** Baur. Carapace brown, with yellowish lines in reticulated pattern; head streaked with yellow, plastron yellow. S. Mo. to Mex.

cc. Lower jaw serrate; upper jaw smooth.

473. DEIROCHELYS (Gr., δείρε, neck; χέλυς, tortoise)

811. **D. reticularia** (Latreille). Chicken Turtle. Similar to *Chrysemys;* no red on marginal shields; a broad yellow band on fore-limb; neck long. Coastal Plain from N. C. to Miss. (Lat., with a network.)

Family CLXVIII. CHELONIIDAE (Loggerhead Turtles)

Sea turtles, with the carapace covered with horny plates; carapace heart-shaped, broad and flat, highest in front, widest near middle; head large, only slightly retractile. Species few, of the open sea, coming to shore to deposit and bury their eggs.

a. Scales around large median plate on top of head 13 to 20; plates of carapace not imbricate; edge of lower jaw not serrate; costal plates 5 on each side; scales on cheeks small, 15 to 20; head broad. . . . . Caretta, 477.

aa. Scales around vertical plate 7; costal plates 4.

b. Cutting edges of lower jaw not serrate; shields of carapace imbricated; scales on cheeks large, 7 to 10; head broad. . . . . Eretmochelys, 476.

bb. Cutting edges of lower jaw serrate; shields of carapace not imbricated; scales on cheeks small, 15 to 20; head high and narrow. . . . . Chelonia, 475.

475. CHELONIA Latreille (Gr., χελώνη, tortoise)

813. **C. mydas** (Linnaeus). Green Turtle. Plates thin; usually 1 blunt claw on 1st digit; body oblong. W. Indies, occasionally N. to Mass. Herbivorous. Reaches 600 lb. Valued as food. (Gr., μυδάω, to be wet.)

476. ERETMOCHELYS Fitzinger (Gr., ἐρέτμος, oar; χέλυς, turtle)

814. **E. imbricata** (Linnaeus). Tortoise-shell Turtle. Hawksbill Turtle. Jaws produced in a beak; nails 2. W. I., rarely N. to Mass. Smaller and fiercer than *C. caretta.* The scales provide the "tortoise-shell" of commerce. (Lat., shingled.)

477. CARETTA Rafinesque (An old name)

815. **C. caretta** (Linnaeus). Loggerhead Turtle. Scales slightly imbricate; 2 nails on each foot; horny ridges in roof of mouth broader anteriorly, and joining, or almost joining, on mid-line. Atl., N. to N. C., occasionally to Mass. Reaches 300 lb.

816. **C. kempii** (Garman). Bastard Turtle. Similar to *C. caretta;* horny ridges in roof of mouth becoming lower anteriorly and widely separated in front. Atl., N. to Cape Hatteras, accidentally to Mass. (For Richard M. Kemp.)

Family CLXIX. DERMOCHELIDAE (The Leather Turtles)

Sea turtles with the body covered by a smooth leathery skin; carapace with several longitudinal ridges with deep grooves between them; body highest in front and widest just before bridge; hind legs much exposed; toes without nails; head short, high, very broad behind; upper jaw with 2 pits and 2 tooth-like projections. One species, widely distributed.

478. DERMOCHELYS Blainville (Gr., δέρμα, skin; χέλυς, tortoise)

817. **D. coriacea** (Linnaeus). Trunkback. Leather Turtle. Dark brown. L. 6 to 8 feet. Open sea, N. to Me. (Lat., leathery.)

Suborder TRIONYCHOIDEA

Neck retractile in vertical plane; carapace without peripheral plates, and covered with leathery skin. River and lake turtles.

Family CLXX. TRIONYCHIDAE (The Soft-shelled Turtles)

Body flat, nearly orbicular; carapace not completely ossified, the ribs projecting freely towards the outer extremities; marginal ossicles rudimentary; carapace and plastron covered by a thick leathery skin, flexible at the margins. Head long and pointed, with a long, flexible, tubular snout; neck long. Feet broadly webbed; toes long, 5–5, but the claws only 3–3.

Aquatic, carnivorous, and voracious; species few, in both hemispheres.

479. AMYDA Agassiz (Lat., turtle)

818. **A. mutica** (Le Sueur). Leather Turtle. Nostrils rather under the tip of snout; nasal septum without an internal longitudinal ridge on each side; head narrow; edge of upper jaw serrate behind. A depression along median line of carapace; no spines or tubercles along anterior margin nor on back. Olive, young spotted; feet not mottled below. L. 12. Middle and northern tributaries, Miss. and St. Lawrence rivers. (Lat., unarmed.)

819. **A. spinifera** (Le Sueur). Common Soft-shelled Turtle. Nostrils terminal, crescent-shaped; a prominent longitudinal ridge projecting from each side of septum; head broad; edge of upper jaw entire, forepart of carapace with conical tubercle. Carapace olive brown with dark spots; head and neck olive green with light stripes on head uniting at base of snout; legs and feet mottled everywhere with dark; ♂ with the tubercles on the front of the carapace smaller than in the ♀, the body also longer and the tail extending considerably beyond the margin of the carapace. Miss. River and tribu-

taries to Colo. and Mont.; St. Lawrence drainage to Va.; W. N. Y. and Pa.; abundant in large streams. (Lat., spine-bearing.)

820. **A. ferox** (Schneider). Similar to *A. spinifera*. Carapace olive or brown, with dull blotches or rings; light stripes on head uniting just in front of eyes. S. C. to Fla. and La. (Lat., fierce.)

Passing over the order *Crocodilia*, the highest in development among recent reptiles, an order having no representatives within our limits, we take up next the Birds, a group originally an offshoot from the Reptilian series, but now, if only living forms are taken into consideration, one of the most sharply defined of the classes of Vertebrata.

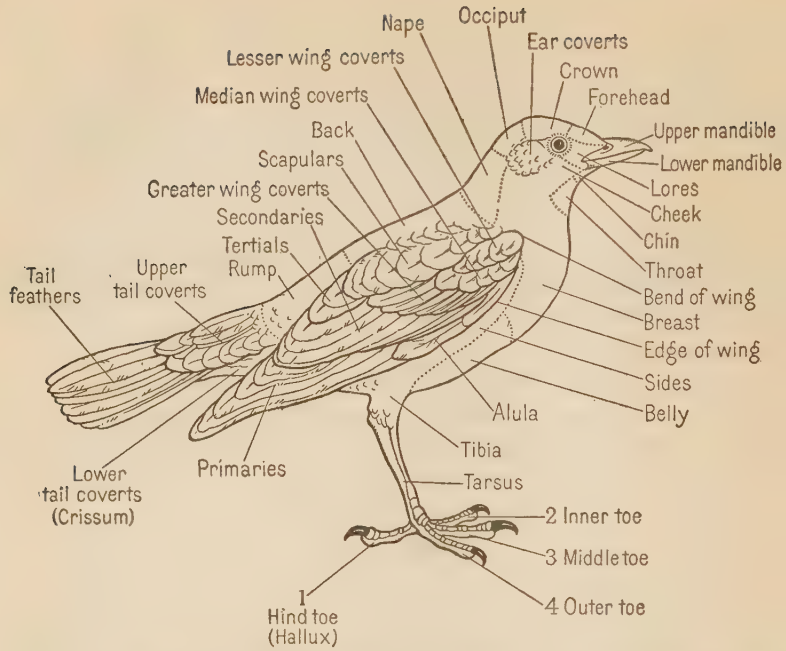


FIG. 7. Diagrammatic outline showing the location and terminology of the external features mentioned in describing a Bird.

CLASS H. AVES (THE BIRDS)

A Bird may be defined as an air-breathing vertebrate with a covering of feathers; warm blood; a complete double circulation; the two anterior limbs (wings) adapted for flying or swimming, the two posterior limbs (legs) adapted for walking or swimming; respiration never effected by gills or branchiae, but, after leaving the egg, by lungs, which are connected with air cavities in various parts of the body. Reproduction by eggs, which are fertilized within the body and hatched externally, either by incubation or exposure to the heat of the sun or of the ground; the shell calcareous, hard, and brittle.

Much more might be added, but the obvious character is this: *All Birds have feathers, and no other animal has feathers,* or as Stejneger puts it, "A bird is known by its feathers." There is probably no other character of importance which distinguishes birds living and extinct as a whole, from the *Reptilia.* Certain extinct birds have teeth in the jaws and long tails, of many vertebrae, with feathers on each side.

The classification of this group, as of most others, is still in an unsettled condition. Strictly speaking, the existing members of the class are so closely related that they might, perhaps with propriety, be combined into one order, which by Professor Gill has been named EURHIPIDURA. The *Eurhipidura* are made a sub-class by Stejneger, while Coues divides them into two "sub-classes — the *Ratitae* (Ostriches, etc.) and the *Carinatae.* To the *Carinatae*, characterized by the keeled sternum and more or less developed wings, all living North American birds belong. (Lat., *avis*, bird.)

The "orders" of the Carinate Birds, as here adopted, are rather temporary, pending investigation of certain groups. They are also in a degree conventional, some of them being admittedly unnatural in their composition, while none of them represent any such structural differences or differences of such long standing in time as those which characterize the orders of Mammals, Reptiles, or even those of Fishes. For reasons elsewhere given, I follow here, with a few exceptions, the classification sequence and nomenclature adopted by the American Ornithologists' Union. A system in some respects more in accord with modern investigations is outlined by Stejneger in the *Standard Natural History;* and another is given by Ridgway in his *Birds of North and Middle America.* The following largely artificial key to the Orders recognized by the American Ornithologists' Union is partly arranged from the key given by Ridgway (*Man. N. Am. Birds.*)

North American Orders of Aves

a. Feet totipalmate, the hind toe well developed and all four toes full-webbed; palate desmognathous (its bones united). . . . . STEGANOPODES, XLIV.

aa. Feet not totipalmate, the hind toe, if present, not connected with the others.

b. Feet palmate, the anterior toes full-webbed or nearly so (or lobate, with the claws broad, nail-like) (tarsus not specially elongate, and the tibia little if any naked below, in our species).

c. Bill not lamellate, its cutting edge not serrated or fringed; palate schizognathous (split). (*Cecomorphae* Huxley, Stejneger.)

d. Legs inserted far behind the middle of the body, which in standing position is more or less erect. . . . . PYGOPODES, XLI.

dd. Legs not inserted far behind the middle of the body, which in a standing position has its axis nearly horizontal; wings usually very long.

e. Nostrils not tubular. . . . . LONGIPENNES, XLII.

ee. Nostrils tubular. . . . . TUBINARES, XLIII.

cc. Bill lamellate, its cutting edges serrated or fringed. . . . . ANSERES, XLV.

bb. Feet not palmate (with rare exceptions), the toes cleft, or webbed at base or on sides (full-webbed only in a few waders, with very long tarsus and the tibia partly naked.)

f. Waders, tibia usually more or less naked below; the tarsus more or less elongate.

g. Hind toes well developed and usually inserted on same level as anterior toes, the claws never excessively lengthened; loral or orbital regions or both naked; palate desmognathous. . . . . HERODIONES, XLVI.

gg. Hind toe, if present, small and inserted above level of the rest (or else size moderate). L. less than 36 inches; the loral and orbital regions feathered; the middle claw not pectinate); palate schizognathous. (*Grallae.*)

h. Hind toe short and elevated (or if the bird is less than 3 feet long, the hind toe almost on the level of anterior toes). . . . . PALUDICOLAE, XLVII.

hh. Hind toe (if present) short and distinctly elevated (length never more than 2 feet). LIMICOLAE, XLVIII.

ff. Not waders; tibia mostly entirely feathered; tarsus not greatly elongate.
i. Bill strongly hooked, with a distinct cere at base; palate desmognathous.
j. Toes 3 in front; 1 behind, the outer toe sometimes reversible. Flesh-eating. RAPTORES, LI.
jj. Toes 2 in front; 2 behind, the outer toe permanently reversed. Fruit-eating. PSITTACI, LII.
ii. Bill not both strongly hooked and cered.
k. Hind toe short, decidedly elevated; toes semipalmate; no soft membrane about nostrils; palate schizognathous. . . . . GALLINAE, XLIX.
kk. Hind toe little if at all above level of the rest (rarely absent).
l. Nostrils opening beneath a soft swollen cere-like membrane; hind claw short; doves. . . . . COLUMBAE, L.
ll. Nostrils not opening beneath a swollen membrance or cere.
m. Hind claw not longer than the others; palate mostly desmognathous. (*Picariae*)
n. Wings not very long; gape not very wide nor deeply cleft. Feet zygodactyl or syndactyl. (Toes 2 in front, or if 3, then the outer and middle toes connected for at least half their length in our species.)
o Tail feathers soft; bill not chisel-like. . . . . COCCYGES, LIII.
oo. Tail feathers stiff and pointed; bill adapted for striking or boring. PICI, LIV.
nn. Wings very long, with 10 primaries (tail of 10 feathers and bill fissirostral, or else secondaries 6 and bill tenuirostral); toes 3 in front, 1 behind, the hinder a little elevated. . . . . MACROCHIRES, LV.
mm. Hind claw at least as long as middle claw; toes always 3 in front, 1 behind, cleft to the base or with the basal joints only immovably coherent; palate aegithognathous. . . . . PASSERES, LVI.

ORDER XLI. PYGOPODES (THE DIVING BIRDS)

Feet palmate or lobate; tibia feathered, included in the skin nearly to the heel joint, hence the legs set far back, so that the birds are scarcely able to walk at all on land; hind toe small and elevated, or wanting; nostrils developed; bill horny, not lamellate or serrate; no gular pouch; palate schizognathous; wings very short; tail very short or rudimentary.

This is not a natural order. Stejneger (following Huxley) unites the *Pygopodes*, *Longipennes*, and *Tubinares* in one order, *Cecomorphae*. He remarks: "The fact is that not only are the gulls very nearly related to the auks, but their affinities with the *Grallae* through the plovers are unmistakable. On the other hand, the grebes seem to be only distantly related to the other *Pygopodes*, and the puffins and albatrosses similarly so to the *Longipennes* or gulls." The *Pygopodes* are water birds, expert divers, feeding chiefly on fishes and other aquatic animals. (Gr., πυγή, rump; πούς, foot.)

Families of Pygopodes

a. Tail feathers wanting; anterior toes lobed, the claws very broad, flat, rounded at tip, resembling human nails. . . . . PODICIPIDAE, CLXXI.
aa. Tail feathers developed, but short. (*Cepphi.*)
b. Toes 4; the hind toe present. . . . . COLYMBIDAE, CLXXII.
bb. Toes 3, the hind toe wanting. . . . . ALCIDAE, CLXXIII.

Family CLXXI. PODICIPIDAE (The Grebes)

Bill slender, or stout; lores naked; head often with crests, ruffs or ear tufts in the breeding season. Under plumage dense, lustrous, mostly white. Wings very short; tail rudimentary, without distinct quills. Feet 4-toed, lobate, the toes webbed at base; toes flattened, provided with flat claws resembling human nails; tarsus scutellate, compressed. Genera several; species about 20; in all parts of the world, chiefly about fresh waters; nest usually a floating mat of rushes.

a. Bill slender, straight, rather acute, its length more than twice its depth at base; head in breeding season with conspicuous crests or ruff.
b. Neck nearly as long as body. . . . . Aechmophorus, 480.
bb. Neck much shorter than body. . . . . Podiceps, 481.
aa. Bill stout, somewhat hooked; its length not quite twice its greatest depth; no ruff nor crest. . . . . Podilymbus, 482.

480. AECHMOPHORUS Coues (Gr., *αἰχμή*, spear; *φόρος*, bearing)

821. **A. occidentalis** (Lawrence). Western Grebe. Slate color; satin-white below. L. 26. W. 8. B. 2¾. Manitoba to Mexico and W.

481. PODICEPS Latham (Lat., *podex*, rump; *ceps*, head)

a. Bill about as long as head. (*Podiceps.*)

822. **P. grisegena holboellii** (Reinhardt). Holboell's Grebe. Upper parts brown; front and sides of neck brownish red; head ashy gray, its top blackish; crests and ruffs not large; below silvery, the feathers gray within. L. 18. W. 8. B. 2. N. Am., S. to N. U. S.; to Fla. in winter. (Lat., *grisegena: griseus*, gray, *gena*, cheek; *holboellii*, to the Danish naturalist, C. Holböll.)

aa. Bill much shorter than head. (*Dytes* Kaup.)

823. **P. auritus** Linnaeus. Horned Grebe. Dark brown; head glossy black in ♂; a buffy patch above and behind eye; fore neck, breast, and sides brownish red; bill compressed, deeper than wide at base, black, tipped with yellow; ruffs very large, in dense tufts. L. 14. W. 6. B. 3¾. N. U. S. and N. to Arctic; S. to Fla. in winter. (*Eu.*) (Lat., *auritus*, having ears.)

824. **P. nigricollis californicus** (Heermann). American Eared Grebe. Crest of ♂ in the form of a buffy fan-shaped patch; head, throat, and breast black in ♂; bill depressed, wider than deep at base. L. 13. W. 5¼. C. Canada S. to Guatemala, E. to Ind. and W. (Lat., *nigricollis: niger*, black; *collum*, neck; *californicus*, of California.)

482. **PODILYMBUS** Lesson (*Podiceps* + *Colymbus*)

825. **P. podiceps** (Linnaeus). Pied-billed Grebe. Diedapper. Dabchick. Hell-diver. Water Witch. Chiefly brownish gray; silvery ash below, spotted with dusky; chin and throat black; bill bluish, with dark band; young and winter plumage different, the bill unmarked, but the bird resembles nothing else. L. 14. W. 5. B. 1. Nearly whole of America, locally abundant. (Lat., *podex*, rump; *ceps*, head.)

Family CLXXII. **COLYMBIDAE** (The Loons)

Bill long, strong, tapering, acute, wholly hard; nostrils linear. Head densely and evenly feathered, without ruffs or naked spaces; eye large. Feet 4-toed, palmate; tarsus reticulate, strongly compressed. Wings comparatively long and strong; tail short but well developed. Precocial. Species few. Birds of large size, with strong powers of flight, and prëeminent in swimming and diving, but scarcely able to walk; they are migratory, breeding northward, but coming S. in winter; the voice is singularly sharp and wild.

483. **COLYMBUS** Linnaeus (Gr. κόλυμβος, diver)

a. Tarsus shorter than middle toe, without claw.

826. **C. immer** (Brünnich). Common Loon. Great Northern Diver. Black; breast and below chiefly white; head and neck iridescent black in summer; a patch of white streaks on each side of neck and on the throat; back with many white spots; young duller, brownish above, without the head markings. L. 28 to 36. W. 15. Ts. 3. B. 3. Northern Hemisphere; U. S. in winter. (*Eu.*) (*immer*, from the Norwegian name of this bird.) The western race, **G. i. elasson** Bishop, is smaller (w. 14), and ranges from Iowa and Wisc. westward, in winter E. to Me. and Fla. (Gr., ἐλάσσων, smaller.)

827. **C. arctica pacifica** (Lawrence). Pacific Loon. Similar, but head and neck behind bluish or hoary gray; fore-neck purplish black, with a crescent of white streaks; young duller. L. 28. W. 12½. B. 2½. Northern N. Am., S. to S. Cal. and N. Y.; not common in U. S. (Lat., *arcticus*, arctic; *pacificus*, calm, i.e., relating to the Pacific Ocean.)

aa. Tarsus longer than middle toe with claw.

828. **C. stellata** (Pontoppidan). Red-throated Loon. Blackish, streaked on neck, chiefly white below; head and neck mostly bluish gray; throat with a large chestnut patch in summer; young duller. L. 27. W. 11. B. 2. Northern N. A. regions, U. S. in winter. (*Eu.*) (Lat., *stellatus*, set with stars, i.e., spotted.

Family CLXXIII. ALCIDAE (The Auks)

Feet palmate, 3-toed; tarsus reticulate or partly scutellate; suffrago naked; claws ordinary; bill and nostrils various; tail perfect, of few feathers; lores feathered; legs variable, set far back; color variable, the head often with curly crests; altricial; eggs few. Genera 15; species about 35, living about rocks on rugged shores in Northern regions. Most of them fly well and all swim on or under water with equal ease. They feed chiefly on fishes.

a. Inner claw much larger and more curved than the others; corner of mouth with a "rosette" of thick naked skin; bill greatly compressed, almost as deep as long. (*Fraterculinae.*)
b. Eyelids with deciduous appendages; no crests; culmen with one curve; covering of bill molted in 7 to 9 pieces. . . . . Fratercula, 484.
aa. Inner claw similar in size and form to the others; no rosette at corner of mouth.
c. Bill not very short, the angle of chin much nearer nostril than tip of bill.
d. Nostril exposed, overhung by a horny scale; culmen straight till near tip, then abruptly decurved. (*Phalerinae.*) . . . . . Cepphus, 485.
dd. Nostril more or less completely concealed by dense velvety feathers. (*Alcinae.*)
e. Bill narrow; neither mandible grooved; tail rounded, the feathers not pointed. Uria, 486.
ee. Bill very deep, much compressed, one or both mandibles grooved in adult; tail graduated, its feathers pointed.
f. Wings well developed; bill (less than $1\frac{1}{2}$) much shorter than head. Alca, 487.
ff. Wings rudimentary, incapable of flight; bill as long as head (about 3). (Now extinct.) . . . . . Plautus, 488.
cc. Bill very short and broad, the angle of chin nearer to tip of bill than to nostril; culmen curved. (*Allinae.*) . . . . . Alle, 489.

484. FRATERCULA Brisson (Lat., *fraterculus*, little brother)

829. **F. arctica deleta** (Brünnich). American Puffin. Grooves of bill oblique, broad and distinct. Blackish above; a black band across fore neck; white below. L. 13. B. $1\frac{3}{4}$. Arctic, S. to N. J. (Lat., *arcticus*, arctic; *deletus*, ended.)

485. CEPPHUS Pallas (Gr., κέπφος, a kind of sea-bird)

a. Greater wing coverts white to their extreme base.

830. **C. mandtii** (Mandt). Mandt's Guillemot. Blackish, with large white wing patch; nearly white in winter. L. 13. W. 7. B. 1. Arctic, S. to Mass. (*Eu.*) (To M. W. Mandt.)

aa. Greater wing coverts with at least their basal half black.

831. **C. grylle** (Linnaeus). Black Guillemot. Bill larger than in *C. mandtii;* size and colors similar. Arctic E. N. A., S. to N. J. (*Eu.*) (*grylle*, a Scandinavian name.)

486. URIA Brisson (Gr., οὐρία, a water bird)

a. Depth of bill at angle of mouth less than $\frac{1}{3}$ culmen.

832. **U. aalge** (Pontoppidan). Murre. Dusky; secondaries white-tipped; basal part of upper tomium dusky. L. 17. W. 8. B. 1⅓. N. Atl., S. in winter to Me. (*Eu.*) (*U. troille* Linnaeus.) (*aalge*, a Danish name of the bird.)

aa. Depth of bill at angle more than ⅓ culmen.

833. **U. lomvia** (Linnaeus). Brünnich's Murre. Dusky; secondaries white-tipped; basal part of upper tomium thickened and light-colored in adult. L. 16. W. 8¼. B. 1½. N. Atl., S. to S. C. and Iowa. (*Eu.*) (*lomvia*, Faeroëse name.)

487. ALCA Linnaeus (Lat., from Icelandic *álka*)

834. **A. torda** Linnaeus. Razor-billed Auk. Black; lower parts and tips of secondaries white; snuffy brown in summer. L. 16½. W. 8¼. T. 3½. B. 1¼. N. Atl., S. to N. C. (*Eu.*) (*torda*, Swedish name of this bird.)

488. PLAUTUS Brünnich (Lat., *plautus*, flat footed)

835. **P. impennis** (Linnaeus). Great Auk. Black above; lower parts and tips of secondaries white. L. 29. W. 5¾. B. 3¼. Formerly N. Atl., S. to Fla.; now wholly extinct. (*Eu.*) "His Grace, the Auk, who lost the use of his wings, and perished off the earth in consequence." (*Coues.*) (Lat., *impennis*, wingless.)

489. ALLE Link (Swedish name of this bird)

836. **A. alle** (Linnaeus). Dovekie. Little Auk. Upper parts black, the secondaries tipped with white; sooty brown in summer. L. 8. W. 4¾. B. ½. Arctic, S. to N. C. (*Eu.*)

Order XLII. LONGIPENNES (The Long-winged Swimmers)

Feet palmate; tibia feathered; legs inserted near the center of equilibrium so that the bird stands with the axis of the body nearly horizontal; hind toe small and elevated, sometimes wanting. Bill usually long, horny, not serrate nor lamellate; nostrils developed, not tubular; no gular pouch. Wings very long and pointed; tail well developed. Palate schizognathous. Altricial. Water birds, of great powers of flight, feeding on various kinds of aquatic life. (Lat., *longus*, long; *penna*, feather.)

a. Bill with the lower mandible not produced nor specially compressed.
  b. Covering of upper mandible in three parts, a hook at tip, a sort of cere overhanging nostrils, and a lateral piece. . . . . Stercorariidae, CLXXIV.
  bb. Covering of upper mandible of a single piece pierced by the nostrils.
    c. Bill hooked; tail usually even or rounded. . . . . Laridae, CLXXV.
    cc. Bill not hooked; tail forked. . . . . Sternidae, CLXXVI.
aa. Bill with the lower mandible much longer than upper, the terminal part of both mandibles much compressed, like a knife blade. . . . . Rynchopidae, CLXXVII.

Family CLXXIV. STERCORARIIDAE (The Jaegers)

Gull-like birds, with the bill hooked and "cered"; tail slightly rounded, with the middle pair of feathers long-exserted; tibia naked below; tarsus scutellate in front, grandular behind. Three genera, with 7 species, "marine Raptores," large, vigorous, rapacious, living by robbing the terns, smaller gulls, and other birds.

a. Depth of bill at base at least half length of upper mandible (measured along side); tarsus shorter than middle toe and claw; tail short, nearly even. . . . Catharacta, 490.
aa. Depth of bill at base not half length of upper mandible; tarsus longer than middle toe and claw; middle tail feathers (in adult) very long.
b. Middle tail feathers rounded at ends. . . . . Coprotheres, 491.
bb. Middle tail feathers pointed at ends. . . . . Stercorarius, 492.

490. CATHARACTA Brünnich (*Megalestris* Bonaparte)

(Gr., καταῤῥάκτης, name of some sea bird)

837. **C. skua** Brünnich. Skua. Skua Gull. Grayish brown. L. 22. W. 16. T. 6. B. 2. N. Atl., rarely S. to Long Island. (*Eu.*) (*Skua*, Faeroëse name of a bird.)

491. COPROTHERES Reichenbach (Gr., κόπρος, excrement; θηράω, I hunt)

838. **C. pomarinus** (Temminck). Pomarine Jaeger. Chiefly blackish above, white below; dark phase all dark brown; middle tail feathers broad to the tip, projecting about 4 inches. L. 20. W. 15. T. 9. B. 1½. Arctic, S. in winter to N. J. (*Eu.*) (*pomarinus*, Gr., πῶμα, lid or cover; ῥίς, nose.)

492. STERCORARIUS Brisson (Lat., *stercorarius*, pertaining to excrement)

839. **S. parasiticus** (Linnaeus). Parasitic Jaeger. Upper parts mostly slaty; lower parts white; dark phase, dark brown; middle tail feathers acuminate, projecting 4 inches. L. 20. W. 13. T. 5½. B. 1¼. Arctic, S. in winter to Brazil. (*Eu.*) (Lat., *parasiticus*, parasitic.)

840. **S. longicaudus** Vieillot. Long-tailed Jaeger. Sooty black and slate color above, below mostly white; tail feathers filamentous, projecting 8 or 10 inches. L. 22. W. 12. T. 13. B. 1⅛. Arctic, S. in winter to Fla. (*Eu.*) (Lat., *longus*, long; *cauda*, tail.)

Family CLXXV. LARIDAE (The Gulls)

Long-winged swimmers, with the nostrils not tubular. Bill more or less hooked at tip, long, horny, not serrate nor lamellate; nostrils developed; no gular pouch. Feet palmate; tibia feathered; legs near center of equilibrium; hind toe elevated, small, not included in the webbing, sometimes wanting. Wings very long and pointed. Tail long, usually even or nearly so. General

color mostly white, with a darker mantle of a pearly bluish tint, and commonly with some black markings. Sexes alike in color, but the plumage varying much with age and season. Species numerous, abounding about all large bodies of water; of remarkable power of flight. Altricial; food chiefly aquatic animals.

a. Tarsus rough or serrate behind; tail even. . . . . PAGOPHILA, 493.
aa. Tarsus nearly entire behind.
b. Hind toe rudimentary or wanting, with minute claw or none; tail slightly emarginate. RISSA, 494.
bb. Hind toe small, but with a perfect claw.
c. Tail even or somewhat rounded.
e. Head white in adult in summer, grayish in young, mantle grayish blue. LARUS, 495.
ee. Head black in adult in summer; mantle gray; belly rosy in breeding season. CHROICOCEPHALUS, 496.
cc. Tail forked. . . . . XEMA, 497.

493. PAGOPHILA Kaup (Gr., πάγος, ice; φιλέω, I love)

841. **P. alba** (Gunnerus). IVORY GULL. Adults pure white; young spotted; feet black. L. 16 to 20. W. 13. B. 1½. Arctic, rarely to U. S. in winter. (*Eu.*) (Lat., *albus*, white.)

494. RISSA Stephens (Icelandic name of the bird)

842. **R. tridactyla** (Linnaeus). KITTIWAKE. KITTIWAKE GULL. Mantle bluish gray; head, etc., white; hind claw a minute knob, sometimes absent. L. 16 to 18. W. 12. Arctic, S. in winter to Va. (*Eu.*) (Gr., τριδάκτυλος, three fingered.)

495. LARUS Linnaeus (Gr., λάρος, a ravenous sea bird)

a. Primaries without any black, pearl gray, whitish at tip.

843. **L. hyperboreus** Gunnerus. GLAUCOUS GULL. ICE GULL. BURGOMASTER. Mantle pale gray, head white, bill yellow, with red spot on lower mandible; size large. L. 30. W. 18. T. 8. B. 2½. Arctic regions; S. in winter to N. C. (*Eu.*) (Lat., *hyperboreus*, northern.) (*L. glaucus* Brünnich.)

844. **L. glaucoides** Faber. ICELAND GULL. Similar but smaller. L. 25. W. 15½. T. 6½. B. 1⅔. Arctic, S. to Md. (*Eu.*) (*L. leucopterus* Faber.) (Lat., *glaucus*, glaucous; Gr., εἶδος, appearance.)

aa. Primaries with white and dusky (sometimes all black in young).
b. Dark spaces on primaries gray.

845. **L. kumlieni** Brewster. KUMLIEN'S GULL. Similar to *L. glaucoides*. L. 24. W. 16. B. 1¾. Hudson Bay to Greenland, S. to N. Y. in winter. (To Ludwig Kumlien, a Wisconsin naturalist.)

bb. Dark spaces on primaries black.
c. Shafts of primaries white throughout.

846. **L. marinus** Linnaeus. Great Black-backed Gull. Mantle blackish slate-color. One of the largest of our gulls. L. 30. W. 18. B. 2½. Feet flesh-colored. N. Atl., S. in winter to Chesapeake Bay and Fla. (*Eu.*) (Lat., *marinus*, marine.)

cc. Shafts of primaries black in the black markings.

847. **L. varius smithsonianus** Coues. American Herring Gull. Mantle pearl gray; bill without black band. L. 25. W. 17. B. 2¼. Feet flesh-colored. Northern regions, abundant along the coast and on all large inland bodies of water, S. in winter to Yucatan. (Lat., *varius*, different; *smithsonianus*, to the Smithsonian Institution.) (*L. argentatus* of authors.)

848. **L. delawarensis** Ord. Ring-billed Gull. Mantle pearl gray; feet yellowish; bill yellowish, a black band at the tip in adult; smaller. L. 20. W. 15. B. 1⅜. N. Am.; abundant, S. to Mexico. (To the State of Delaware.)

496. CHROICOCEPHALUS Eyton (Gr., χρωικός, colored; κεφαλή, head)

a. Tarsus much longer than middle toe and claw.

849. **C. atricillus megalopterus** (Bruch). Laughing Gull. Black-headed Gull. Bill and feet dusky; reddish in summer. L. 15 to 17. W. 13. T. 5. B. 1¾. East. U. S., S. to Mexico, chiefly coastwise. (Lat., *atricillus*, black-tailed; *megalopterus:* Gr., μέγας, large; πτερόν, wing.)

aa. Tarsus not longer than middle toe and claw.

850. **C. pipixcan** Wagler. Franklin's Gull. Bill and feet carmine; bill usually with a dark band near tip; size medium. L. 14½. W. 11. B. 1⅓. U. S., chiefly W. of the Miss. R., central-S. Canada and S. to Chile. (*C. franklinii* Richardson.) (*pipixcan*, an Aztec name.)

851. **C. philadelphia** (Ord). Bonaparte's Gull. Bill black, slender, tern-like; size small. L. 13. W. 10. B. 1⅕. N. Am.; abundant. (To the city of Philadelphia.)

497. XEMA Leach (A coined word)

852. **X. sabini** (Sabine). Sabine's Gull. Fork-tailed Gull. Largely white, a plumbeous hood and black collar. L. 14. W. 11. Arctic, S. in winter to Peru; scarce. (*Eu.*) (To Edward Sabine.)

Family CLXXVI. STERNIDAE (The Terns)

Long-winged swimmers, much like the gulls, but with the bill not hooked, the mandibles even, and the tail usually deeply forked. Water birds with a swift flight, usually smaller than the gulls, commonly with a black cap in full plumage, sometimes wholly dusky. Species numerous along seashores.

a. Tail with its outer feathers narrow and pointed; toes well webbed; color pale gray or white, with black cap in full plumage; quills dusky, with a long white stripe.
b. Bill stout, its depth at base about one third its length. . . . . GELOCHELIDON, 498.
bb. Bill slender, its depth at base not one third its length.
c. Tail much less than ½ wing, not deeply forked. . . . . HYDROPROGNE, 499.
cc. Tail not much less than ½ wing, forked for ½ its length. . . . . STERNA, 500.
aa. Tail with its outer feather broad and rounded; toes scant webbed; color dark. CHLIDONIAS, 501.

498. GELOCHELIDON Brehm (Gr., γελάω, I laugh; χελιδών, swallow)

853. **G. nilotica aranea** (Wilson). AMERICAN GULL-BILLED TERN. Bill black, very short and stout; head black; mantle pearl gray. L. 15. W. 12. T. 4½. Atl., N. to Me. (Lat. *niloticus*, of the river Nile; *araneus*, pertaining to the spider.)

499. HYDROPROGNE Kaup (Gr., ὕδωρ, water; Πρόκνη, daughter of Pandion, who was turned into a swallow)

854. **H. caspia imperator** (Coues). AMERICAN CASPIAN TERN. Primaries without white band; bill red. L. 22. W. 17. T. 6. B. 3. North America. Much the largest of the terns. (*caspia*, of the Caspian Sea; Lat., *imperator*, a ruler, chief.)

500. STERNA Linnaeus (Lat., from Eng., *tern*, or *sterne*)

a. Wing more than 9.
b. Wing more than 12.
c. Tail more than one-half wing, forked half its length; occiput crested. (*Thalasseus* Boie.)

855. **S. maxima** Boddaert. ROYAL TERN. Bill orange. L. 18 to 21. W. 15. T. 8. B. 2½. U. S. to Brazil. (Lat., *maximus*, greatest.)

856. **S. sandvicensis acuflavida** Cabot. CABOT'S TERN. Bill black, yellow at tip. L. 16. W. 12½. T. 6. B. 2¼. Atlantic coast, widely diffused, N. to Ontario, S. to Brazil. (From Sandwich, England; Lat., *acuflavidus: acus*, a needle; *flavidus*, yellowish.)

bb. Wing less than 12; tail deeply forked; no crest; mantle bluish gray, the tail chiefly white; inner webs of quills largely white. (*Sterna.*)
c. Top of head black in summer.
d. Outer tail feather with the inner web dusky, the outer web white.

857. **S. forsteri** Nuttall. FORSTER TERN. Tail somewhat longer than in *S. hirundo;* bill and feet orange in adult. L. 15. W. 10. T. 7. B. 1½. N. Am., locally common. (To John Reinhold Forster, an early naturalist.)

dd. Outer tail feather with inner web white; outer web dusky.

858. **S. hirundo** Linnaeus. Common Tern. Bill red, blackening towards tip; feet orange. L. 14½ (13 to 16). W. 10 (9½ to 11¾). T. 6 (5 to 7). B.1⅓. N. Am. to Brazil. (*Eu.*) (Lat., *hirundo*, swallow.)

859. **S. paradisaea** Brünnich. Arctic Tern. Bill carmine throughout; plumage as in *hirundo*, but darker below. L. 14 to 17. W. 10 to 11. T. 7 to 8. B. 1½. Tail proportionally much longer than in *S. hirundo*. Arctic, S. to N. Y. (*Eu.*) (Lat., *paradisus*, a park.)

ddd. Outer tail feather with both webs white.

860. **S. dougalli** Montagu. Roseate Tern. Bill black, usually orange at base below; mantle very pale; rosy-tinted below in breeding season. L. 14 to 17. W. 9½. T. 5 to 8. B. 1½. Atlantic coast, Me. to Brazil. (*Eu.*) (To Dr. McDougall, of Scotland.)

aa. Wing less than 7; tail deeply forked, about half wing. (*Sternula* Boie.)

861. **S. albifrons antillarum** (Lesson). Least Tern. Bill yellow, usually tipped with black; a white frontal crescent between cap and bill; shafts of two or more outer primaries black above; mantle pale gray. Very small. L. 8 or 9. W. 6½. T. 3½. B. 1⅕. E. U. S., S. to Peru, chiefly abundant coastwise. (Lat., *albifrons: albus*, white; *frons*, forehead; *antillarum*, of the Antilles.)

501. CHLIDONIAS Rafinesque (*Hydrochelidon* Boie) (Gr., χελιδών, swallow)

862. **C. nigra surinamensis** (Gmelin). American Black Tern. Head, neck and under parts black (in full plumage); wings and tail above dark like the back; crissum white. L. 10. W. 8. T. 3½. B. 1$\frac{1}{10}$. N. Am. and S. Am., chiefly inland. (Lat., *niger*, black; *surinamensis*, of Surinam.)

Family CLXXVII. RYNCHOPIDAE (The Skimmers)

Gulls with the lower mandible much longer than the upper, compressed like a knife-blade; its two sides completely soldered together; the upper edge as sharp as the lower, and fitting in a groove in upper mandible; tip of bill obtuse; upper jaw compressed, movable at base; tongue very short, stumpy. Wings very long. Otherwise similar to the terns. One genus, with 5 species.

502. RYNCHOPS Linnaeus (Gr., ῥύγχος, beak; ὤψ, face)

863. **R. nigra** Linnaeus. Black Skimmer. Shearwater. Glossy black; white below; lower mandible about an inch longer than upper. L. 17 to 20. W. 15. T. 5, sharply forked. B. 2½. Tropical Am., N. to Me., abundant S. (Lat., *niger*, black.)

Order XLIII. TUBINARES (The Tube-nosed Swimmers)

Nostrils tubular; bill with the upper mandible hooked, its covering composed of several pieces separated by deep grooves. Otherwise essentially like the *Longipennes* so far as external characters are concerned. (Lat., *tubus*, tube; *naris*, nostril.)

a. Nostrils united in a double tube, placed horizontally on the culmen.
Hydrobatidae, CLXXVIII.

Family CLXXVIII. HYDROBATIDAE (The Petrels)

Nostrils tubular, united together in a double tube placed horizontally. Bill hooked at tip, its covering not continuous, consisting of several horny pieces separated by deep grooves; hind toe minute or absent. Wings long and pointed; tail moderate; feet short, the front toes full webbed. Plumage compact and oily, not varying much with sex, age, or season. Gregarious sea birds, mostly silent, with remarkable powers of flight, rarely landing except to lay their eggs. Species about 90. Closely allied to the Petrels are the Albatrosses (*Diomedeidae*), huge sea birds with the nostrils disconnected, not united in a horizontal "double-barrelled tube." These families together constitute the order of *Tubinares*.

a. Secondaries 13 or more in number.
b. Wing long (more than 7).
c. Partition between nostrils very thin (much narrower than nostril).
d. Gonys very slightly if at all concave, shorter than nasal tubes. . . Fulmarus, 503.
dd. Gonys very strongly concave, longer than nasal tubes. . . . Pterodroma, 506.
cc. Partition between nostrils very thick, as wide as nostril; nostrils visible from above.
e. Bill stout, nearly half as deep as long; nasal tubes very prominent.
Calonectris, 504.
ee. Bill relatively slender, not nearly half so deep as long; nasal tubes only moderately prominent. . . . . Puffinus, 505.
bb. Wings shorter (less than 7).
f. Tail even or slightly rounded. . . . . Hydrobates, 507.
ff. Tail slightly forked. . . . . Oceanodroma, 508.
aa. Secondaries 10; tarsus not scutellate; legs long; claws narrow, pointed. Oceanites, 509.

503. FULMARUS Stephens (Lat., from Eng., *fulmar*)

864. **F. glacialis** (Linnaeus). Fulmar. Bill stout, nearly half as deep as long; nasal tubes dusky. Color bluish gray or dusky. L. 18. W. 12. B. 1½. N. Atl., S. to N. J. (*Eu.*) (Lat., *glacialis*, pertaining to ice.)

504. CALONECTRIS Mathews and Iredale (Gr., καλός, beautiful; νηκτρίς, a swimmer.)

865. **C. kuhlii borealis** (Cory). Cory's Shearwater. White of throat shading gradually into dusky of head and neck. L. 21. W. 14. B. 2⅕. Off New England. (To Heinrich Kuhl; Lat., *borealis*, northern.)

505. PUFFINUS Brisson (Lat., from Eng., *puffin*)

a. Dusky above; white below.
b. Wing more than 12.

866. **P. gravis** (O'Reilly). Greater Shearwater. White of throat separated rather abruptly from dusky of head and neck; rump with white. L. 20. W. 12. B. 1⅛. Atl., from Arctic Circle to Cape Horn. (*Eu.*) (Lat., *gravis*, heavy.)

bb. Wing less than 10.

867. **P. assimilis lherminieri** Lesson. Audubon's Shearwater. Grayish black; color not below eye; crissum with dusky. L. 11. W. 8. T. 3½. B. 1¼. Tropics, N. to N. Y. (Lat., *assimilis*, similar; *lherminieri*, to F. J. Lherminier.)

aa. Dusky below as well as above.

868. **P. griseus** (Gmelin). Sooty Shearwater. Whale Bird. Bill dusky. L. 16. W. 12. B. 1⅜. Southern Hemisphere, N. to Gulf of St. Lawrence and Alaska in summer. This species swarms about whales attacked by the Great Killer (*Orcinus orca*). (Lat., *griseus*, gray.)

506. PTERODROMA Bonaparte (Gr., πτερόν, wing; δρομάω, I run)

869. **P. hasitata** (Kuhl). Black-capped Petrel. Upper tail coverts and lower parts white; upper parts mostly blackish; tail graduated. L. 16. W. 11. T. 5. B. 1⅛. Atl., N. to Ontario, possibly now extinct. (*Eu.*) (Lat., *haesitatus*, stuck fast, or hesitating, the describer being in doubt.) A related species, *P. inexpectata* (Forster), was redescribed by Brewster as *Aestrelata scalaris* from a single example taken on the Genesee River at Mount Morris, N. Y.

507. HYDROBATES Boie (Gr., ὕδωρ, water; βάτης, one who treads)

870. **H. pelagicus** (Linnaeus). Stormy Petrel. Dusky; upper tail coverts white, edged with black. L. 5¾. W. 4⅔. T. 2½. E. Atl., rarely W. to N. E. North Am. (*Eu.*) (Gr., πελαγικός, relating to the sea.)

508. OCEANODROMA Reichenbach (Gr., ὠκεανός, ocean; δρομάω, I run)
(subgenus *Cymochorea* Coues)

871. **O. leucorhoa** (Vieillot). Leach's Petrel. Sooty, upper tail coverts white; feet black. L. 8. W. 6½. T. 3½. Northern seas, S. to Va. in winter. (*Eu.*) (Gr., λευκός, white; ὄρρος, rump.)

509. OCEANITES Keyserling & Blasius (Gr., *ὠκεανίτης*, son of the sea)

872. **O. oceanicus** (Kuhl). Wilson's Petrel. Sooty; wings and tail black; upper tail coverts white. L. 7. W. 6. T. 3. Tarsus 1⅓. Cosmopolitan, N. to Labrador; common. (*Eu.*) (Gr., *ὠκεανικός*, oceanic.)

Order XLIV. STEGANOPODES (The Totipalmate Birds)

Swimmers with all 4 toes full-webbed; hind toes lengthened, scarcely elevated; tibia feathered; bill horny, not lamellate; nostrils very small or abortive; no basipterygoids; palate desmognathous, a prominent gular pouch; tarsus reticulate. Altricial. "Notwithstanding the shortness of the legs and the character of the toes . . . the birds of the present order are unquestionably nearly related to the *Herodii*" (*Stejneger*). Of this small order, most of the species are sea birds, active and voracious, about half of all being cormorants. (Gr., *στεγανόποδες*, web-footed animals; *στεγανός*, covered; *πούς*, foot.)

Families of Steganopodes

a. Upper mandible not hooked at tip.
  b. Bill very thick through base, the tip slightly curved; tail moderate, graduated, the feathers rather pointed. . . . . Sulidae, CLXXIX.
  bb. Bill slender, nearly straight; neck very long and slender; tail long, fan-shaped when spread, the feathers very broad. . . . . Anhingidae, CLXXX.
aa. Upper mandible hooked at tip.
  c. Tarsus moderate, much longer than hind toe with claw.
    d. Bill compressed; gular sac small. . . . . Phalacrocoracidae, CLXXXI.
    dd. Bill much flattened; gular sac very large. . . . . Pelecanidae, CLXXXII.
  cc. Tarsus extremely short, not longer than hind toe with claw; wings and tail excessively long, the latter deeply forked. . . . . Fregatidae, CLXXXIII.

Family CLXXIX. SULIDAE (The Gannets and Boobies)

Bill long, cleft to beyond eyes, very stout at base, the tip not hooked, the tomia irregularly serrate; a nasal groove, but the nostril abortive; gular sac small, naked; wings long, pointed; tail long and stiff, with pointed feathers; feet stout. Body heavy, similar to that of a goose, the tissues under the skin with air chambers as in the Pelicans. Species few. Gregarious sea birds found in most regions.

510. MORIS Leach (Lat., *morus*, foolish)

873. **M. bassana** (Linnaeus). Gannet. White, black on wings; yellowish on head; young dark brown, spotted. Lower jaw, chin, and throat densely feathered. L. 36. W. 20. T. 10. B. 6. N. Atl., N. to Greenland, S. to Florida, common N. (*Eu.*) (From Bass Rock, Eng., where Gannets breed.)

Family CLXXX. ANHINGIDAE (The Darters)

Bill very long, straight, slender, sharp, the tomia finely serrate; gular sac small, naked; nostrils minute, becoming obsolete; tail long, stiff, fan-shaped, when spread, the feathers broad, the middle pair in the adult transversely corrugated. Neck long, very slender, the vertebrae (20 in number) of peculiar structure; feet short, far back. Swift, wary birds, their appearance when partially submerged in the water resembling that of a snake. Species few.

511. ANHINGA Brisson (South American name of the bird)

874. **A. anhinga** (Linnaeus). Water Turkey. Darter. Snakebird. Chiefly black, with greenish luster above; neck with hair-like plumes; ♀ largely buffy. L. 35. W. 14. T. 11. B. 3¼. Tropical Am., N. to S. Ill. and Kansas.

Family CLXXXI. PHALACROCORACIDAE (The Cormorants)

Bill slender, about as long as head, nearly terete, but compressed, strongly hooked, the cutting edges uneven; gular pouch present, relatively small. Wings short; tail very large, almost woodpecker-like, of very stiff feathers, often used as a support for the body; legs set far back; a nasal groove with abortive nostrils. Colors in both sexes lustrous, iridescent black; in the breeding season usually with long, white, filamentous plumes; many species crested. Species few, but found in most regions, chiefly inhabiting rocky coasts, where they are gregarious and voracious. In China and Japan they are often trained to catch river fishes.

512. PHALACROCORAX Brisson (Gr., φαλακροκόραξ, cormorant)

a. Tail of 14 feathers.

875. **P. carbo** (Linnaeus). Common Cormorant. Shag. Head, neck and belly blue black; back brownish, streaked with black; sac yellow, heart-shaped behind; young grayish. L. 36. W. 14. T. 7½. Northern regions, S. to S. C. (*Eu.*) (Lat., *carbo*, coal.)

aa. Tail of 12 feathers.

876. **P. auritus** (Lesson). Double-crested Cormorant. Glossy greenish black; back and wing coverts slaty brown; adult with 2 curly black lateral crests; sac convex or straight-edged behind, yellowish. L. 33. W. 13. T. 7. E. and cent. N. Am. Our commonest species. (Lat., *auritus*, having ears.)

877. **P. olivaceus mexicanus** (Brandt). Mexican Cormorant. Brown-

ish black; back slaty; gular sac orange, white-edged. L. 24. W. 10. B. 2. S. W., N. to S. Ill. (Lat., *olivaceus*, olivaceous; *mexicanus*, Mexican.)

Family CLXXXII. **PELECANIDAE** (The Pelicans)

Bill very long, rather slender, straight, grooved throughout, with a claw-like hook at the end; the broad space between the branches of the lower jaw occupied by a huge membranous sac; nostrils abortive; wings very long; tail very short, of 20 or more feathers; feet short, stout. Skin of breast and belly with large air cells beneath it, so that the body is rendered better able to float. These air cells occupy the usual position of the fat-cells. Sexes alike. Species few; found in most warm regions, about bays and lakes. Gregarious, greedy, fish-eating birds, clumsy on the wing.

513. **PELECANUS** Linnaeus (Gr., πελεκάν, pelican)

a. Tail-feathers 24; lower jaw feathered. (*Cyrtopelicanus* Reichenbach.)

878. **P. erythrorhynchos** Gmelin. White Pelican. White, with black on wings and some yellowish on breast and occiput; bill, pouch, and feet yellowish. L. 60. W. 24. B. 2. Temperate N. Am.; fairly common S. and W., often inland, rare on Atl. coast. (Gr., ἐρυθρός, red; ῥύγχος, beak.)

aa. Tail feathers 22. (*Leptopelecanus* Reichenbach.)

879. **P. occidentalis** (Linnaeus). Brown Pelican. Color dark; head mostly white, bill dark, feet black; sac dusky. Smaller; Tropical Am., N. to Nova Scotia (casually). (Lat. *occidentalis*, western.)

Family CLXXXIII. **FREGATIDAE** (The Man-of-War Birds)

Bill long, rather slender, straight, strongly hooked at tip. Gular sac moderate. Wings very long and pointed; tail very long, deeply forked; feet very small, the feathered tarsus very short; webbing narrow; middle claw pectinate.

Sea birds of tropical regions, the immense wings giving them a power of flight surpassed by no other bird. They live mainly by robbing the terns and gulls, which they watch, often from great heights in the air. The 4 species range widely in the warm seas.

514. **FREGATA** Lacépède (Ital., *fregata*, frigate)

880. **F. magnificens rothschildi** Mathews. Man-of-War Bird. Frigate Bird. Black, the shoulders lustrous in ♂. L. 40. W. 25. T. 17½. B. 4⅜. Tropical seas, occasional N. to Wisconsin and Nova Scotia. (Lat., *magnificens*, distinguished; *rothschildi*, to Walter Rothschild.)

Order XLV. ANSERES (The Ducks and Geese)

Desmognathous swimmers with the basipterygoids more or less developed and the feet not totipalmate; bill lamellate; no gular pouch. Feet 4-toed, palmate; hind toe small, elevated. Legs short. This order (often called *Lamellirostres*, associated with the Flamingoes, etc., to form the *Chenomorphae* of Huxley and Stejneger) " opens the series of desmognathous birds, which are characterized by having the palatal bones united across the middle either directly or by the intermediation of ossifications in the nasal septum." (*Stejneger.*)

This familiar order contains nearly all the waterfowl which are valued in domestication or as game birds. As here understood, the *Anseres* comprise but a single family (*Anatidae*); the *Phoenicopteridae* or Flamingoes, wading birds with a duck's bill, being now placed in a distinct order *Odontoglossae*, by the American Ornithologists' Union. (Lat., *anser*, goose.)

Family CLXXXIV. ANATIDAE (The Ducks)

Bill lamellate; that is, furnished along each cutting edge with a regular series of tooth-like processes, which correspond to certain laciniate processes of the fleshy tongue, which ends in a horny tip; bill large, thick, high at base, depressed towards the end, membranous except at the obtuse tip which is occupied by a horny nail. Body heavy, flattened beneath. Head high, compressed, with sloping forehead; eyes small. Tail various, usually short, of 14 to 16 feathers, the lower coverts being long and full. Legs and feet short; anterior toes full-webbed. Tibia feathered. Sexes usually quite unlike (excepting among the Swans and Geese). Species numerous, of all parts of the world; migratory; all are good swimmers, and most of them valued as food.

a. Neck shorter than body; lores feathered.
  b. Tarsus scutellate in front, shorter than middle toe without claw. Sexes usually unlike in color. (Ducks.)
    c. Lower mandible without trace of lamellae along the side, but with a series of distinct, tooth-like serrations along the upper edge (inner tomium); bill narrow, head more or less crested; hind toe lobate. Fish ducks. (*Merginae.*)
      d. Serrations of both mandibles very conspicuous, tooth-like, strongly recurved at tip. Mergus, 515.
      dd. Serrations of mandibles short, blunt, not distinctly recurved at tips. Lophodytes, 516.
    cc. Lower mandible with a very distinct series of lamellae along side besides the series along upper edge; bill rather broad.
      e. Hind toe without distinct membranous lobe; "river ducks." (*Anatinae.*)
        f. Bill not spatulate, scarcely widened toward tip.
          g. Tail feathers narrow, rather pointed, no crest.
            h. Tail not very acute, the middle feathers not produced in ♂.
              i. Culmen longer than middle toe with claw.
                j. Speculum violet, bordered with black, bill rather broad. . Anas, 517.
                jj. Speculum not violet.
                  k. Wing coverts in both sexes sky blue, the greater coverts white-tipped; scapulars in male striped with blue and buff; bill rather broad. speculum green. . . . . Querquedula, 518,

kk. Wing coverts leaden gray; no blue; bill very narrow. NETTION, 519.

ii. Culmen shorter than middle toe with claw.

l. Lamellae on bill numerous, fine, more than 30 visible from the outside. CHAULELASMUS, 520.

ll. Lamellae coarse, less than 15 visible externally; bill shorter than head. MARECA, 521.

hh. Tail pointed, the middle feathers much produced in ♂; ♀ with tail much shorter (speculum violet). . . . . DAFILA, 523.

gg. Tail feathers broad, rounded at tip; top of head with a high crest. AIX, 524.

ff. Bill spatulate, narrow at base and very broad toward the tip. . SPATULA, 522.

ee. Hind toe with a broad, membranaceous lobe; "sea ducks." (*Fuligulinae.*)

m. Tail feathers with their bases well hidden by the coverts.

n. Feathering on lores or forehead not reaching forward beyond posterior border of nostril.

o. Graduation of tail less than length of bill from nostril; width of nail not ⅓ width of bill at middle.

p. Bill about equal to inner toe with claw.

q. Base of culmen deeply concave; bill very slightly hooked. ARISTONETTA, 526.

qq. Base of culmen not deeply concave; bill strongly hooked. PERISSONETTA, 528.

pp. Bill decidedly shorter than inner toe with claw.

r. Tip of bill squarish, its width at posterior end of nail not less than 2½ times the length of nail. . . . . FULIX, 527.

rr. Tip of bill much rounded, its width at posterior end of nail less than 2½ times the length of nail. . . . . NYROCA, 525.

oo. Graduation of tail much more than length of bill from nostril.

s. Bill ordinary, not gibbous nor appendaged.

t. Nail of bill narrow, distinct; tail moderate.

u. Nostril anterior, its front much nearer tip of bill than loral feathers (eyes yellow). . . . . GLAUCIONETTA, 529.

uu. Nostril sub-basal, its front much nearer loral feathers than tip of bill; (eyes brown). . . . . CHARITONETTA, 530.

tt. Nail of bill large, fused; tail in ♂ with its middle feathers produced, about as long as wing; (no speculum). CLANGULA, 531.

ss. Bill variously gibbous or else appendaged on base or on side.

v. Bill not gibbous, but appendaged with a lobe at base of commissure; (speculum violet). . HISTRIONICUS, 532.

vv. Bill not gibbous, but with a leathery expansion on side of upper mandible; cheeks bristly; (speculum white). CAMPTORHYNCHUS, 533.

vvv. Bill gibbous at base, then broad, depressed, with a large fused nail and without frontal processes.

w. Bill in male scarcely encroached upon by frontal feathers; nostrils median. . . . . OIDEMIA, 535.

ww. Bill in male conspicuously encroached upon by frontal feathers; nostrils beyond middle of bill. MELANITTA, 536.

nn. Feathering on forehead or lores reaching anteriorly to or beyond posterior end of nostril; bill gibbous at base and with large frontal processes; (no speculum). . . . . SOMATERIA, 534.

mm. Tail feathers with their bases scarcely concealed by the short coverts; tail more than half length of wing, much graduated, the feathers with narrow webs and very stiff shafts.

x. Nail of bill very small, bent backward beneath tip of upper mandible; outer toe longer than middle. ERISMATURA, 537.

xx. Nail of bill normal, not very narrow; outer toe shorter than middle toe. . . . . NOMONYX, 538.

bb. Tarsus reticulate all around, the plates rather larger in front; tarsus not shorter than middle toe without claw. Sexes similar. (Geese.) (*Anserinae.*)

y. Serrae on cutting edge of upper mandible visible from outside for most of its length; tomium decidedly sinuate or concave; (bill and feet pale).

z. Bill very stout, its depth at base more than half its length above. (Color largely white.) CHEN, 539.

zz. Bill smaller and more depressed, its depth at base not half its length. (Color not white.) ANSER, 540.

yy. Serrae on upper mandible scarcely visible except near angle of mouth, the edge scarcely sinuate; nostril near middle of nasal fossa; (head, bill, and feet mostly black). . . . . BRANTA, 541.

aa. Neck not shorter than body; lores partly naked. Color white. (Swans.) (*Cygninae.*)

a2. Bill not tuberculate; tail rounded; outer primaries with sinuate webs. . CYGNUS, 542.

515. MERGUS Linnaeus (Lat., *mergus*, a diver)

a. Nostril nearer middle of bill than base. (*Mergus.*)

881. **M. merganser americanus** Cassin. AMERICAN MERGANSER. GOOSANDER. FISH DUCK. ♂ black and white above, lower parts creamy white; a black bar across white of wing coverts; head glossy green, scarcely crested; ♀ smaller, ashy gray; head brownish. L. 24. W. 11. B. 2. T. 5. N. Am.; common. (Lat., *merganser: mergus*, a diver; *anser*, a goose; *americanus*, American.)

aa. Nostrils near base of bill. (*Serrator.*)

882. **M. serrator** (Linnaeus). RED-BREASTED MERGANSER. Similar; head crested; ♂ with breast reddish brown, black-streaked; wing with 2 black bars, instead of one as in preceding. L. 24. W. 9. T. 4. B. 2⅛. N. Am.; common. (*Eu.*) (Lat., *serrator*, one who saws.)

516. LOPHODYTES Reichenbach (Gr., λόφος, crest; δύτης, diver)

883. **L. cucullatus** (Linnaeus). HOODED MERGANSER. SHELDRAKE. Black and white; speculum white with 2 dark bars; sides chestnut in ♂; ♀ duller and grayish; crest high and compressed; nostrils sub-basal. L. 19. W. 8. T. 4. B. 1½. N. Am.; common. (*Eu.*) (Lat., *cucullatus*, hooded.)

517. ANAS Linnaeus (Lat., *anas*, duck)

884. **A. platyrhyncha** (Linnaeus). MALLARD. DOMESTIC DUCK. Culmen longer than middle toe without claw. ♂ head and upper neck rich glossy green, a white ring below; breast purplish chestnut; speculum violet, with black and white before and behind it; ♀ duller, chiefly ochraceous, streaked with brown; known by the violet speculum bordered with black and white. L. 24. W. 12. N. Am.; abundant, commonest westward. Original of the

common domestic duck (*A. boschas* [*L.*]; various hybrids of this species with others are described. (*Eu.*) (Gr., πλατύς, broad; ῥύγχος, bill.)

885. **A. rubripes** Brewster. Red-Legged Black Duck. Size of the mallard and resembling the ♀, but darker; both sexes entirely dusky, varied with brown; no decided white except under the wings. Feet orange red. E. N. Am., breeding in Canada. (Lat. *ruber*, red; *pes*, foot.) The breeding race of the United States, **A. r. tristis** Brewster, is similar, but has olive-brown feet.

518. QUERQUEDULA Stephens (Lat., *querquedula*, a kind of small duck)

886. **Q. discors** (Linnaeus). Blue-winged Teal. Wing coverts in both sexes light bluish, the greater ones white-tipped; speculum green. ♂ head and neck blackish plumbeous, darkest on the crown; a white crescent in front of eye; under parts thickly dark spotted; scapulars in male striped with blue and buff; bill rather broad; ♀ dull streaky brownish and buffy, known by the wings. L. 16. W. 7. T. 3. N. A., S. in winter to Chile; abundant in W. (Lat., *discors*, discordant.)

887. **Q. cyanoptera** (Vieillot). Cinnamon Teal. ♂ chiefly chestnut; top of head blackish; ♀ dull and streaky. L. 17. W. 7½. S. W. Canada S. to S. South Am., straying E. to N. Y. (Gr., κυανός, blue; πτερόν, wing.)

519. NETTION Kaup (Gr., νῆττιον, duckling)

888. **N. carolinense** (Gmelin). Green-winged Teal. Wing coverts leaden gray, without blue; bill narrow. Head and upper neck rich chestnut in ♂; a green patch behind eye; upper parts with wavings of black and white; white below; buffy on breast, with dark spots; white crescent on sides in front of wings. ♀ different, known by the small size and color of wing. L. 15. W. 7½. T. 3½. N. Am. to West Indies and Cent. Am.; common. One of the smallest as well as one of the best of the ducks as food. (Lat., *carolinensis*, of Carolina.)

520. CHAULELASMUS Bonaparte (Gr., χαῦλος, gaping; ἐλασμός, a plate)

889. **C. streperus** (Linnaeus). Gadwall. Gray Duck. Lamellae numerous, fine, more than 30 visible from outside; culmen shorter than middle toe without claw. ♂ barred, black and white; middle wing coverts chestnut, greater coverts black; speculum white. ♀ dusky and tawny with little chestnut, known by the wings. L. 22. W. 11. T. 4½. N. Am. to Mex. and W. I.; not rare. (*Eu.*) (Lat., *streperus*, noisy.)

521. MARECA Stephens (Brazilian name for a kind of duck)

890. **M. penelope** (Linnaeus). European Widgeon. Lamellae coarse, less than 15 visible externally, bill shorter than head. Head and neck cinna-

mon; in ♂ top of head brownish white; sides of head with slight traces of green. Europe; rare in America. (Gr., Πηνελόπη, wife of Ulysses.)

891. **M. americana** (Linnaeus). Baldpate. American Widgeon. Head and neck grayish in ♂, speckled with dusky; top of head white; sides of head with bright-green patch; speculum glossy green, preceded by black, white, and gray on wing coverts; ♀ duller. L. 20. W. 11. T. 4½. N. Am. to Cent. Am. and W. I. (*Eu.*) Common. (Lat., *americanus*, American.)

522. SPATULA Boie (Lat., *spatula*, spoon)

892. **S. clypeata** (Linnaeus). Shoveller. Spoon-bill Duck. ♂ head and neck green; breast white; belly chestnut; wing coverts blue; speculum green, bordered by black and white; rump and tail coverts black; ♀ streaky brownish, known by the bill and wings. L. 20. W. 9½. B. 2¾. N. Am. to W. I. and N. South Am.; common. (*Eu.*) (Lat., *clypeum*, shield.)

523. DAFILA Stephens (A coined word)

893. **D. acuta tzitzihoa** (Vieillot). American Pintail. Sprigtail. ♂ head dark brown, with purplish gloss; side of neck with a long white stripe; back and sides gray, finely waved with darker; lower parts white; crissum black; speculum violet, with black, white, and buffy; tail wedge-shaped when developed, central feathers black and much projecting; ♀ speckled and streaked, the tail much shorter; bill dusky; feet grayish blue. L. 20 to 30. W. 11. T. 9 or less. N. Am. S. to Panama; abundant. A slender, trimly built duck. (Lat., *acutus*, sharp; *tzitzihoa*, Aztec name of the species.)

524. AIX Boie (Gr., αἴξ, a water bird)

894. **A. sponsa** (Linnaeus). Wood Duck. Summer Duck. Bride. Crested; ♂ head iridescent green and purple, with white stripes and a forked white throat patch; back varied, black, green, etc.; breast rich chestnut; sides buffy, finely waved with dark; speculum green; tips of primaries frosted; ♀ duller; varied with white; head mostly gray. L. 20. W. 9½. T. 5. U. S. and S. Canada, locally common, nesting in trees, the most elegant of all N. Am. ducks. (Lat., *sponsa*, bride.)

525. NYROCA Fleming (*Marila* Oken) (Lat., from Russian *Nyrok*, name of a duck)

895. **N. americana** (Eyton). Redhead. American Pochard. ♂ with head and neck chestnut with red reflections; back silvery and black, the dark waved lines unbroken; breast, rump, etc., black; belly white; speculum bluish gray, tipped with white; ♀ duller; bill and feet dull bluish. L. 20. W. 10. T. 2. B. 2⅛. N. Am. to Mexico; abundant. (Lat., *americanus*, American.)

526. ARISTONETTA Baird (Gr., *ἄριστος*, noblest; *νῆττα*, a duck)

896. **A. valisineria** (Wilson). CANVAS-BACK. Head and neck dark reddish brown; black wavy lines on back broken, the whitish predominating; bill dusky. L. 23. W. 9. T. 3. B. 2⅔. N. Am., S. to Guatemala, especially coastwise in winter. A bird when well fed highly valued by epicures, but ordinarily not superior to any of the river ducks. (From *Vallisneria spiralis*, the "Wild Celery," on which the bird feeds.)

527. FULIX Sundevall (Lat., *fulix*, coot)

897. **F. marila nearctica** (Stejneger). AMERICAN SCAUP DUCK. GREATER SCAUP. GREATER BLUE-BILL. RAFT DUCK. Head, neck, and breast black; no ring about neck; back and sides whitish, the back finely waved with black; speculum white, tipped with black; ♀ with face white; head and neck snuffy brown with mostly greenish reflections. L. 19. W. 8½. Northern N. A., S. to southern U. S., abundant. (Gr., *μαρίλη*, charcoal; Lat., *nearcticus*, nearctic; *i.e.*, North American.)

898. **F. affinis** (Eyton). LESSER SCAUP DUCK. LESSER BLUE-BILL. Similar, but smaller, and head with mostly purplish reflections. L. 16. W. 7¾. N. Am.; common. (Lat., *affinis*, allied.)

528. PERISSONETTA Oberholser (Gr., *περισσός*, extraordinary; *νῆττα*, a duck)

899. **P. collaris** (Donovan). RING-NECKED DUCK. ♂ with an orange-brown collar about neck; blackish above; speculum bluish gray; crissum black; lower parts white; wings brown; ♀ chiefly brown, without collar. L. 18. W. 8½. T. 2¾. N. Am., S. to Guat. and W. I.; not common. (Lat., *collaris*, collared.)

529. GLAUCIONETTA Stejneger (*Clangula* of recent authors) (Gr., *γλαύκιον*, a kind of duck; *νῆττα*, a duck)

900. **G. clangula americana** (Bonaparte). AMERICAN GOLDEN-EYE. GARROT. ♂ head puffy, glossy green, with a round white spot before eye; upper parts black; white continuous on outer surface of wing; ♀ head duller, snuff-colored, scarcely puffy; the body brownish. L. 16 to 19. W. 8½. T. 3½. N. Am. to Mexico; common. (Lat., *clangula*, diminutive of *clangor*, a noise; *americanus*, American.)

901. **G. islandica** (Gmelin). BARROW'S GOLDEN-EYE. Similar; head almost crested in ♂; gloss of head purplish; a triangular white space before eye along base of bill; white of wing divided by a dark line; ♀ head dark brown. L. 22. W. 10. T. 3¾. N. U. S. and N.; rare. (*Eu.*) (Lat., *islandicus*, of Iceland.)

530. CHARITONETTA Stejneger (Gr., χάρις, grace; νῆττα, duck)

902. **C. albeola** (Linnaeus). Buffle-head. Butterball. Spirit Duck. Dipper. ♂ with head very puffy and iridescent; no white before eye but a large white posterior patch; wing coverts and secondaries mostly white. L. 16. W. 7. ♀ smaller, dark gray, the head scarcely puffy, with white behind eye. N. Am. to Mexico. An expert diver. (Lat., *albeolus*, whitish.)

531. CLANGULA Leach (*Harelda* Stephens)
(Lat., *clangula*, diminutive of *clangor*, a noise)

903. **C. hyemalis** (Linnaeus). Old Squaw. South-southerly. Long-tailed Duck. Blackish and whitish; head, neck, and lower parts mostly white in winter; a patch of gray on head; breast brownish black; bill black and orange; tail very long; ♀ quite different, mostly grayish brown, with short tail. L. 20. W. 9. T. 3 (♀) to 9 (♂). Northern N. A., S. in winter to Fla. and S. Cal. Notes more or less melodious. (*Eu.*) (Lat., *hyemalis*, pertaining to winter.)

532. HISTRIONICUS Lesson (Lat., *histrionicus*, relating to an actor)

904. **H. histrionicus** (Linnaeus). Harlequin Duck. Lords and Ladies. ♂ leaden bluish, much varied with black, white, and chestnut; a white patch before eye; speculum violet-purple; ♀ dark brown, with gray, etc.; a white spot before eye and one behind ear; bill very short. L. 17. W. 8. T. 4. B. $1\frac{1}{10}$. N. Am., S. to Fla. (*Eu.*)

533. CAMPTORHYNCHUS Bonaparte (Gr., καμπτός, flexible; ῥύγχος, bill)

905. **C. labradorius** (Gmelin). Labrador Duck. ♂ head, neck, chest, and wings white; rest of body with ring about neck and strip on crown black; ♀ chiefly grayish. L. 24. W. 9. N. Atl., S. to N. J.; the species now extinct. (Lat., *labradorius*, of Labrador.)

534. SOMATERIA Leach (Gr., σῶμα, body; ἔριον wool)

a. Frontal processes long, acute, or clubbed, extending in line with culmen on each side of forehead; feathers on side of bill advancing to below nostril; scapulars white; top of head black; no V-mark on chin. (*Somateria.*)

906. **S. mollissima borealis** (Brehm). American Eider Duck. ♂ in breeding dress white; under parts, rump, quills, and crown patch black; ♀ reddish brown, streaked; angle on side of forehead broad and rounded. L. 24. W. 12. T. 4. Arctic Am.; S. to Mass. in winter. (Lat., *mollissimus*, very soft; *borealis*, northern.) Another N. E. American form with clubbed frontal processes is **S. m. dresseri** Sharpe. (To H. E. Dresser, English ornithologist.)

aa. Frontal processes broad, squarish, nearly vertical, out of line of culmen; feathers on side of bill not reaching nostrils. (*Erionetta* Coues.)

907. **S. spectabilis** (Linnaeus). King Eider. ♂ chiefly black; neck, breast, etc., white; a black V-shaped mark on chin; ♀ brownish, known by the bill. L. 22. W. 11. T. 4. Northern regions; S. in winter to Ga. and Cal. (*Eu.*) (Lat., *spectabilis*, conspicuous.)

535. OIDEMIA Fleming (Gr., *οἴδημα*, swelling)

908. **O. americana** Swainson. American Scoter. ♂ entirely black; ♀ sooty brown, paler below and on throat. L. 17 to 20. W. 10. T. 4. N. Am., largely coastwise; S. in winter to Fla. (Lat., *americanus*, American.)

536. MELANITTA Boie (Gr., *μέλας*, black; *νῆττα*, a duck)

a. Bill in ♂ broadly encroached upon by frontal feathers; large white wing patch. (*Melanitta* Boie.)

909. **O. deglandi** Bonaparte. White-winged Scoter. Surf Duck. ♂ black; white spot under eye and white on wings; bill orange-tipped; feet orange; ♀ sooty brown. L. 21. W. 11. N. Am.; S. in winter to Fla. and L. Cal. (To C. D. Degland, European naturalist.)

aa. Bill in ♂ narrowly encroached upon by frontal feathers; no white on wings. (*Pelionetta* Kaup.)

910. **O. perspicillata** (Linnaeus). Surf Scoter. Sea Coot. ♂ black, with white spot on forehead and nape; ♀ sooty brown; white patch on lores and cheeks; size of *O. americana*. N. Am., mostly coastwise; S. in winter to Fla. (*Eu.*) (Lat., *perspicillatus*, conspicuous.)

537. ERISMATURA Bonaparte (Gr., *ἔρεισμα*, prop; *οὐρά*, tail)

911. **E. jamaicensis** (Gmelin). Ruddy Duck. Chiefly brownish or tawny, glossy chestnut in full plumage; considerably waved and dotted, lower parts mottled silver white; crissum white; ♀ brown, mottled with dusky. L. 17. W. 6. T. 3½. N. Am., S. to Guatemala and W. I.; frequent; an expert diver. (Lat., *jamaicensis*, of Jamaica.)

538. NOMONYX Ridgway (Gr., *νόμος*, custom; *ὄνυξ*, nail)

912. **N. dominicus** (Linnaeus). Masked Duck. Redder than the last; forehead and chin black. L. 13½. W. 6¼. Trop. Am., straying N. to Wisc., Mass., Vt., and Md. (Lat., *dominicus*, of San Domingo.)

539. CHEN Boie (Gr., *χήν*, goose)

913. **C. hyperborea** (Pallas). Snow Goose. Adult pure white, sometimes stained with reddish on head; primaries black; young grayish; feet red-

dish, the claws dark; bill red; lamellae very prominent. L. 30 to 38. W. 17. T. 6½. B. 2½. N. Am., chiefly W. (Lat., *hyperboreus*, northern.) The form of the Atlantic Coast is **C. h. atlantica** Kennard; larger than the western bird. (Lat., *atlanticus*, of the Atlantic Ocean.)

914. **C. caerulescens** (Linnaeus). BLUE GOOSE. Grayish brown, the rump and wing coverts gray; head and neck white; size and form of preceding. E. N. Am.; rare. (Lat., *caerulescens*, bluish.)

540. ANSER Brisson (Lat., *anser*, goose)

915. **A. albifrons gambelli** Hartlaub. WHITE-FRONTED GOOSE. SPECKLED BELLY. Grayish brown, mottled, forehead and tail coverts white; bill pink; feet yellow; nostrils basal. L. 27. W. 17. Ts. 3. B. 1¾ to 2. N. Am.; common W. of Mts. The domestic goose, **A. anser** (L.), is a European relative. (Lat., *albifrons: albus*, white; *frons*, forehead; *gambelli*, to Wm. Gambel.)

541. BRANTA Scopoli (Lat., from Eng., *brant*)

a. Forehead black; cheeks and chin white; no white stripes on neck.

916. **B. canadensis** (Linnaeus). CANADA GOOSE. WILD GOOSE. Grayish brown; the feathers more or less edged with lighter, paler below; head and neck black; tail black; upper coverts and crissum white. L. 36. W. 20. T. 7½. B. 2. N. Am.; U. S. chiefly in winter; the commonest of our geese. (Lat., *canadensis*, of Canada). Runs into subspecies westward. **B. c. hutchinsii** (Richardson) is occasional eastward.

aa. Forehead, cheeks, and chin black; white stripes on neck.

917. **B. bernicla** (Linnaeus). BRANT. Head, neck, front, quills, and tail black; white patch on neck; white on rump, crissum, etc.; back brownish gray. L. 24. W. 13. T. 5. B. 1⅓. Northeast. N. A., S. in winter to Fla. (*Eu.*) (Old Eng., *bernekke*, Lat., *bernaca*, possibly same as *barnacle;* these geese once supposed to hatch from barnacles.)

aaa. Bill and feet black; head and neck black, with white spaces.

918. **B. leucopsis** (Bechstein). BARNACLE GOOSE. Blackish; white on rump, sides of head, and throat. L. 28. W. 7. Bill 1½. Europe, occasional in east. N. A., S. to N. C. (*Eu.*) (Gr., λευκός, white; ὄψις, face.)

542. CYGNUS Linnaeus (Lat., *cygnus*, swan)

919. **C. columbianus** (Ord). WHISTLING SWAN. Tail 20-feathered; bill not longer than head; lores with a yellow spot; nostrils sub-terminal. L. 50. W. 20. T. 8. B. 4. N. Am., to Northern Mex., mostly coastwise. (Lat., *columbianus*, of the Columbia R.)

920. **C. buccinator** Richardson. TRUMPETER SWAN. Plumage white, sometimes washed with rusty; young grayish; tail (normally) 24-feathered; bill black, longer than head; lores without yellow spot; nostrils median. L. 60. W. 27. T. 9. B. 4½. N. Am., S. to Tex., E. to N. Y. and Delaware; now very rare. (Lat., *buccinator*, trumpeter.)

ORDER XLVI. HERODIONES (THE HERONS AND STORKS)

Desmognathous waders, without basipterygoid processes; the feet not palmate. Birds mostly (but not always) of large size, with compressed bodies, long legs, and a very long S-bent neck of 15 to 17 vertebrae; tibia naked below; toes long and slender, cleft or slightly webbed, the hind toe long and usually not elevated, provided with a large claw. Wings broad, rounded; tail short. Head contracted to the stout base of the bill, which is long and usually hard and acute, with sharp cutting edges; nostrils small, elevated part of head often naked. Altricial. The species live about water, feeding on fishes, reptiles, rodents, etc., which are speared by a thrust of the bill. The leading families are represented in our fauna. (Lat., *herodias*, a heron.)

Families of Herodiones

a. Sides of upper mandible with a deep narrow groove, extending from the nostrils to the tip; skull schizorhinal.
  b. Bill very broad, much flattened, and greatly widened toward tip, only the point decurved. (Spoonbills.) . . . . . PLATALEIDAE, CLXXXV.
  bb. Bill slender, subterete, gradually decurved for its whole length (Ibises). THRESKIORNITHIDAE, CLXXXVI.
aa. Sides of upper mandible without long groove; skull holorhinal.
  c. Hind toe inserted more or less above the level of the others; its claw short; claws broad and flat, resting on a horny pad or shoe; middle claw not pectinate. (Storks.) CICONIIDAE, CLXXXVII.
  cc. Hind toe inserted on the level of the rest; claws narrow, arched; the middle one pectinate on its inner edge; bill straight, pointed. (Herons.) . ARDEIDAE, CLXXXVIII.

FAMILY CLXXXV. PLATALEIDAE (THE SPOONBILLS)

Bill long, flat, broad and spoon-shaped at the end, otherwise essentially as in the Ibises. Species few in most regions. (Lat., *Platalea*, spoonbill.)

a. Trachea simple (not convoluted within the thorax). . . . . AJAIA, 543.

543. AJAIA Reichenbach (Brazilian name)

921. **A. ajaja** (Linnaeus). ROSEATE SPOONBILL. Chiefly pink and white, back and wings rose pink, under parts deeper; tail buffy; skin of the bald head variegated. L. 34. W. 15. B. 7; its width 2. T. 5. Tropical America, N. casually to Wisc. and Pa.

Family CLXXXVI. THRESKIORNITHIDAE[1] (The Ibises)

Bill very long and slender, compressed, cylindric, curved throughout, the upper mandible with a deep groove reaching nearly or quite to tip; legs rather long, the toes slightly webbed at base. Head more or less naked; plumage stork-like, without powder-down tracts; wings broad; tail short; tarsus scutellate in front, in our species. Skull schizorhinal. Species about 25; of the lakes and swamps of warm regions. Sexes alike in appearance. (Gr., *θρῆσκος*, religious; *ὄρνις*, bird.)

a. Head of adult wholly naked anteriorly; no crest; claws curved. . . . . Guara, 544.
aa. Head of adult feathered except on lores; crown with a short crest; claws nearly straight. Plegadis, 545.

544. GUARA Reichenbach (Brazilian name)

922. **G. alba** (Linnaeus). White Ibis. Spanish Curlew. Pure white, tips of longer quills glossy black. L. 24. W. 11. T. 4. B. 7. South America and Southern States, N. to S. D. and Vt. (Lat., *albus*, white.)

545. PLEGADIS Kaup (Gr., *πληγάς*, scythe)

923. **P. falcinellus** (Linnaeus). Glossy Ibis. Rich dark purplish chestnut; head, back, wings, and tail metallic purplish green. L. 24. W. 11. T. 4. B. 4½. Tropics, rarely N. in E. N. A. to Nova Scotia and Ontario. (*Eu.*) (Lat., *falcinellus*, diminutive of *falcinus*, from *falx*, scythe.)

Family CLXXXVII. CICONIIDAE (The Storks)

Bill longer than head, very stout at base, not grooved, tapering to the tip; nostrils high, close to base of bill; tarsus reticulate; hind toe more or less elevated; claws short, not acute; skull holorhinal. Species few, in damp places in warm regions. The famous migratory stork of Europe (*Ciconia ciconia* L.) is the best-known member of the group. (Lat., *Ciconia*, a stork.)

a. Bill decurved at tip; hind toe scarcely elevated; trachea simple, not convoluted within thorax. (*Mycteriinae.*) . . . . . Mycteria, 546

546. MYCTERIA Linnaeus (Gr., *μύκτερ*, nose) (*Tantalus* Linnaeus)

924. **M. americana** (Linnaeus). Wood Ibis. White, wings and tail mostly glossy black; the bald head livid bluish and yellowish. L. 46. W. 18. B. 7. Tropical Am., N. to Southern states, rarely N. to Vt. and Mont. (Lat., *americanus*, American.)

[1] The original type of the genus *Ibis* was a stork.

Family CLXXXVIII. ARDEIDAE (The Herons)

Bill straight, longer than the head, compressed, acute, with sharp cutting edges; upper mandible grooved; nostrils linear; lores naked, the bill appearing to run directly to the eyes; rest of head feathered; parts of the body with "powder-down tracts"; that is, strips of short, dusty or greasy down-like feathers; usually 3 pairs of these strips, — on the back above the hips, on the belly under the hips, and on the breast; usually long plumes from the back of head in the breeding season. Wings broad. Tail very short. Tibiae largely naked below; toes long and slender, hind toe on a level with the rest, its claw longer than middle claw, which is pectinate. Skull holorhinal. Sexes usually colored alike, but the changes due to age and season are often considerable. Species about 100; in most parts of the world, abundant in the warmer regions; wading in shallow water, feeding chiefly on fishes and sometimes on burrowing rodents.

a. Tail feathers 10, very short, scarcely stiffer than the coverts; outer toe shorter than inner; no conspicuous crest or train in breeding season. (*Botaurinae.*)
  b. Size large. (L. 25); sexes and young all similar. . . . . Botaurus, 547.
  bb. Size small. (L. 14); sexes different. . . . . Ixobrychus, 548.
aa. Tail feathers 12, rather long, stiffer than the coverts; outer toe not shorter than inner; claws shorter, and more curved. (*Ardeinae.*)
  c. Bill long and slender, at least 5 times as long as deep at base, shorter than tarsus.
    d. Large; length (in adult) more than 35 inches.
      e. Tarsus not twice middle toes without claw.
        f. Color chiefly slaty blue above; dorsal plumes short; head crested. Ardea, 549.
        ff. Color white; no crest; back in breeding season with long plumes. Casmerodius, 550.
    dd. Small; length about 24 inches.
      g. Color pure white, at all times; plumes of breeding season, long, recurved, with loose webs. . . . . Egretta, 551.
      gg. Color slaty blue, the head and neck maroon, the young nearly or quite white; plumes relatively slender, with compact webs. . . . . Florida, 552.
      ee. Tarsus twice as long as middle toe without claw; color slaty, head and neck cinnamon. . . . . Dichromanassa, 553.
  cc. Bill not shorter than tarsus; L. less than 30; Scapular plumes of male hair-like, straight, reaching beyond tail. . . . . Hydranassa, 554.
  h. Scapular plumes of male short, soft, with compact webs. . . . Butorides, 555.
ccc. Bill rather short and thick, not more than 4 times as long as thick at base. Night Herons.
  i. Bill about as long as tarsus; gonys nearly straight. . . . . Nycticorax, 556.
  ii. Bill shorter than tarsus; gonys convex. . . . . Nyctanassa, 557.

547. BOTAURUS Stephens (Lat., *botaurus*, a bittern)

925. **B. lentiginosus** (Montagu). American Bittern. Stake Driver. Thunder Pumper. Tawny brown, of various shades, excessively variegated everywhere; fore neck striped with buffy; a dark patch on each side of neck. L. 23 to 28. W. 12. T. 4½. B. 3. N. Am., S. to Guatemala and W. I. (*Eu.*) Common. Noted for its booming. (Lat., *lentiginosus*, freckled.)

548. IXOBRYCHUS Billberg (Gr., *ἰξός*, reed; *βρύχω*, I bellow)

926. **I. exilis** (Gmelin). Least Bittern. ♂ chiefly glossy greenish black above, brownish yellow below, neck, shoulders, and wings with chestnut; a buffy area on wing coverts. ♀ with brown instead of black. L. 14. W. 5. T. 1¾. B. 1¾. Temperate N. Am., to Brazil, in reedy swamps, rather scarce. (Lat., *exilis*, small.)

549. ARDEA Linnaeus (Lat., *ardea*, heron)

927. **A. herodias** Linnaeus. Great Blue Heron. Grayish blue, marked with black and white; crown black with white center; forehead white; lower parts dusky, striped with white; tibia and edge of wing with cinnamon brown. L. 42 to 50. W. 19. B. 6¼. Ts. 7. T. 7. ♀ smaller. N. Am., to S. Am.; generally common. Several subspecies in South and West. (Lat., *herodius*, heron.)

550. CASMERODIUS Gloger (Gr., *χάσμα*, the open mouth; *ἐρωδιός*, heron) (*Herodias* Boie)

928. **C. albus egretta** (Gmelin). American Egret. White Crane. L. 40. W. 17. B. 5. Ts. 6. Patagonia, N. to S. Canada, once much sought for its nuptial plumes and thus nearly exterminated. (Lat., *albus*, white; *egretta*, from French, *aigrette*, an egret.)

551. EGRETTA Forster (Lat., from French, *aigrette*, egret, heron)

929. **E. thula** (Molina). Snowy Egret. L. 24. W. 12. B. 3. T. 4. Tropical America, N. to Nova Scotia and B. C.; once abundant. (*E. candidissima*, [Gmelin].) (*Thula*, Chilean name of the bird.)

552. FLORIDA Baird (To the State of Florida)

930. **F. caerulea** (Linnaeus). Little Blue Heron. Color slaty blue, the head and neck maroon; the young almost wholly white; plumes slender, with compact webs. L. 24. W. 12. T. 4. B. 3. Ts. 4. E. Am., N. to Nova Scotia and Ont., S. to Argentina; common. (Lat., *caeruleus*, blue.)

553. DICHROMANASSA Ridgway (Gr., *δίχροος*, two colored; *ἄνασσα*, queen)

931. **D. rufescens** (Gmelin). Reddish Egret. Slate color; head and neck cinnamon; young grayish; tarsus twice middle toe without claw. L. 30. W. 13. B. 4. Ts. 5. Guatemala, N. to Ill. (Lat., *rufescens*, reddish.)

554. HYDRANASSA Baird (Gr., *ὕδωρ*, water; *ἄνασσα*, queen)

932. **H. tricolor ruficollis** (Gosse). Louisiana Heron. Scapular plumes in ♂ hair-like, reaching beyond tail. Variegated; leaden blue, chestnut, and

white. L. 27. W. 10. B. 4. Ts. 4. Central Am., N. to Ind. (Lat., *tricolor*, three-colored; *ruficollis: rufus*, reddish; *collum*, neck.)

555. BUTORIDES Blyth (Lat., *butio*, or *butor*, bittern; Gr., *εἶδος*, appearance)

933. **B. virescens** (Linnaeus). Green Heron. Scapular plumes not very long, soft, with compact webs, wing not more than 8. Crown, back, and wings, lustrous dark green; neck purplish cinnamon; throat and fore neck striped with whitish; young similar. L. 18. W. 7. B. 2¼. Ts. 2. N. Am., N. to Ont. and Nova Scotia; abundant. (Lat., *virescens*, greenish.) Several subspecies in West and S. to N. South Am.

556. NYCTICORAX Forster (Gr., *νύξ*, night; *κόραξ*, raven)

934. **N. nycticorax naevius** (Boddaert). Black-crowned Night Heron. Qua-bird. Quawk. Bluish gray; crown, back, and shoulders glossy green; lower parts mostly white; no peculiar feathers save 2 or 3 long, white occipital plumes; young grayish brown, speckled and streaked with whitish, very different. Bill about as long as tarsus; gonys nearly straight. L. 24. W. 12. B. 3. Ts. 3. T. 5. Central N. A., S. to Patagonia; common. (Lat., *naevius*, spotted.)

557. NYCTANASSA Stejneger (Gr., *νύξ*, night; *ἄνασσα*, queen)

935. **N. violacea** (Linnaeus). Yellow-crowned Night Heron. Grayish plumbeous, darker on back, and streaked with black; head mostly black, the crown and crest tawny white; occipital plumes similar to those of last; a white streak behind eye; back with long plumes; young grayish brown, streaked and spotted with brown. Bill much shorter than tarsus; gonys convex. L. 24. W. 12. T. 5. B. 2¾. Ts. 3¾. Tropical; Peru, N. to Ont. and Nova Scotia. (Lat., *violaceus*, violet-colored.)

Order XLVII. PALUDICOLAE (The Cranes and Rails)

A small order of wading birds, with schizognathous palate, allied to the *Limicolae*, but with the head compressed rather than globose, the bill hard and not sensitive, not adapted for probing in the mud, and the hind toe much or little elevated. Precocial. Birds of moderate or large size, living about swamps and sluggish streams. The position and boundaries of this group have been unsettled. It seems nearly related to the *Limicolae*. (Lat., *palus*, swamp; *incola*, an inhabitant.)

Families of Paludicolae

a. Nasal bones schizorhinal; head partly unfeathered or else with ornamental plumes; hind toe short, much elevated; size very large. (*Cranes.*) Megalornithidae, CLXXXIX.

aa. Nasal bones holorhinal; head feathered, except sometimes a frontal shield; hind toe rather long, little elevated; size moderate or small. Rails. . . RALLIDAE, CXC.

FAMILY CLXXXIX. MEGALORNITHIDAE (THE CRANES)

Very large birds, with the legs and neck extremely long, the latter of 17 vertebrae. Wings large, rather short. Tail short, of 12 broad feathers. Head more or less naked, with scattered hair-like feathers. Plumage compact, without downy tracts. Bill as long or longer than head, straight and slender; tibia extensively naked; tarsus scutellate; toes rather short; hind toe highly elevated; nasal bones schizorhinal. Species about 17, of various parts of the world, resembling herons in external form, but similar to the rails in structure.

558. MEGALORNIS Gray (*Grus* of authors) (Gr., μέγας, great; ὄρνις, bird)

936. **M. americana** (Linnaeus). WHOOPING CRANE. WHITE CRANE. Adult pure white with black on wings; bare part of head very hairy; young rusty, the head feathered. L. 50. W. 24. T. 9. Ts. 12. B. 6. C. and E. N. Am. to cent. Mex.; now nearly extinct. A wild bird, avoiding civilization. "The windpipe is quite as long as the bird itself, 50 inches or more, and over 2 feet of it coiled away in the keel of the breast-bone, which is entirely hollowed out to receive these extraordinary convolutions; the voice is singularly raucous and resonant." (*Coues.*) (Lat., *americanus*, American.)

937. **M. canadensis** (Linnaeus). LITTLE BROWN CRANE. Adult leaden gray, never whitening. Rather smaller; N. Am., migrating across the Middle West to Mex. (Lat., *canadensis*, of Canada.) A larger form is **M. c. mexicana** (Müller). SAND-HILL CRANE. Slaty gray or brownish, never white; head sparsely hairy. L. 46. W. 22. B. 5½. T. 9. Ts. 10. S. Can. and U. S. to Mex., chiefly S. and W. (Lat., *mexicanus*, of Mexico.)

FAMILY CXC. RALLIDAE (THE RAILS)

Birds of medium or small size, with compressed bodies and large muscular legs. Wings short, rounded, concave; tail very short, of 10 or 12 soft feathers. Hind toe rather short, a little elevated; front toes very long. Bill various, rather short, not sensitive at tip. Plumage blended, changing little with age, sex, or season. Species numerous, of most parts of the world, skulking in swamps and marshes, gathering their food chiefly from the surface.

a. Forehead feathered; no frontal shield. (*Rallinae.*)
  b. Bill slender, decurved, longer than head, with narrow nasal groove, and linear nostril. RALLUS, 559.
  bb. Bill stout, straight, not longer than head, with broad nasal groove and oblong nostril.
    c. Secondaries without white.
      d. Wing more than 4; back streaked. . . . . PORZANA, 560.
      dd. Wing less than 4; back spotted or barred. . . . . CRECISCUS, 562.
    cc. Secondaries white. . . . . , COTURNICOPS, 561.

aa. Forehead covered with a broad, bare, horny shield.
e. Toes scarcely or not lobate. (*Gallinulinae.*)
f. Nostrils small, oval. . . . . Ionornis, 563.
ff. Nostrils slit-like. . . . . Gallinula, 564.
ee. Toes lobate, edged with broad flaps. (*Fulicinae.*) . . . . . Fulica, 565.

559. RALLUS Linnaeus (Lat., *rallus*, rail; Fr., *râle*, from its note)

a. Large rails; wing more than 5.

938. **R. longirostris crepitans** Gmelin. Clapper Rail. Salt-water Rail. Marsh Hen. Olive brown, variegated with ashy; dull cinnamon brown below; little chestnut anywhere. L. 14 to 16. W. 6. T. 2¼. B. 2½. ♀ smaller. Salt marshes; common N. C., N. to Mass. (Lat., *longirostris: longus*, long; *rostrum*, bill; *crepitans*, clattering.)

939. **R. elegans** Audubon. King Rail. Fresh-water Rail. Brownish black, with bright chestnut below and on wing coverts; brighter colored than the last, and larger; a reddish, rather than a gray bird. L. 18. W. 7. B. 2¼. U. S., in fresh-water marshes, N. to Me. and Ont. (Lat., *elegans*, elegant.)

aa. Small rails; wing less than 5.

940. **R. virginianus** Linnaeus. Virginia Rail. Colors as in *R. elegans;* size much smaller. L. 10. W. 4. T. 1½. B. 1½. S. Canada to Guatemala. (Lat., *virginianus*, of Virginia.)

560. PORZANA Vieillot (Italian name)

941. **P. carolina** (Linnaeus). Sora. Carolina Rail. Olive brown, streaked; adult with face and middle line of throat black; breast slaty gray; back streaked with black; no white secondaries; belly barred. L. 9. W. 4⅓. T. 2. N. Am., S. to Peru. (*Eu.*, casual.) Common. (To Carolina.)

561. COTURNICOPS Bonaparte (Lat., *Coturnix*, quail; Gr., ὤψ, face)

942. **C. noveboracensis** (Gmelin). Yellow Rail. Buffy, blackish streaked above, with white marks; buffy below; secondaries white. L. 6. W. 3¼. T. 1½. N. Am., S. to Cal. and Gulf States; not common. (Lat., *noveboracensis*, of New York.)

562. CRECISCUS Cabanis (Diminutive of Gr., κρέξ, a crake)

943. **C. jamaicensis stoddardi** Coale. Black Rail. Upper parts blackish, finely dotted and barred with white, hind neck chestnut; head and under parts slate color, whitish posteriorly. L. 5½. W. 2⅞. T. 1⅛. East. U. S., N. to New Eng. (Lat., *jamaicensis*, of Jamaica; *stoddardi*, To H. L. Stoddard.)

563. IONORNIS Reichenbach (Gr., *ἰον*, violet; *ὄρνις*, bird)

944. **I. martinicus** (Linnaeus). Purple Gallinule. Olive green; head and lower parts purplish blue; wings and tail greenish black; crissum white; bill mostly red; the shield blue. L. 12. W. 7. T. 3. Tropical Am., N. to Wisc. and Quebec. (*Eu.*, accid.) (Lat., *martinicus*, of Martinique I.)

564. GALLINULA Brisson (Diminutive of Lat., *gallina*, hen)

945. **G. chloropus cachinnans** Bangs. Florida Gallinule. Brownish olive above, grayish black on head and below; wings and tail dusky; bill, frontal shield, and ring around tibia red; feet greenish. L. 14. W. 7½. T. 3½. Ts. 2. S. states, straying N. to Minn. and Quebec, and W. to Cal. The typical form is found in Europe. (*chloropus:* Gr., *χλωρός*, green; *πούς*, foot; Lat., *cachinnans*, laughing.)

565. FULICA Linnaeus (Lat., *fulica*, a coot)

946. **F. americana** Gmelin. American Coot. Mud Hen. Dark slate-color or sooty, with white on wings and crissum; bill pale in adult, with a brown spot near tip; frontal shield dark brown. L. 14. W. 8. T. 2. C. Canada and Greenland, S. to Colombia; abundant in reedy swamps. An excellent swimmer.

Order XLVIII. LIMICOLAE (The Shore Birds)

This division of the old order of *Grallae* includes the allies of the Plover and Snipe, as distinguished from the nearly related Cranes and Rails on the one hand and the remotely related Herons and Ibises on the other. Some of the external characters of the group are the following: Tibia more or less naked below; legs long; hind toe free and elevated, often wanting. Head globose, abruptly sloping to the base of the bill, completely feathered (except in the male of *Machetes*, the European Ruff); gape short; bill weak, flexible, more or less soft-skinned and sensitive at tip in most cases, adapted for probing in the mud; nostrils slit-like, surrounded by soft skin. Schizognathous; precocial. The *Limicolae* are all birds of small or moderate size, abundant on sandy shores and in marshes. In spite of the difference in appearance and habits, these birds have anatomically much in common with the gulls. (Lat., *limus*, mud; *incola*, an inhabitant.)

Families of Limicolae

a. Toes lobate, with distinct lateral membranes; tarsus extremely compressed.
Phalaropodidae, CXCI.

aa. Toes not lobate; webbed or not.
b. Tarsus more than twice middle toe with claw; naked part of tibia much longer than middle toe with claw; feet palmate or not; bill very long and slender.
Recurvirostridae, CXCII.

bb. Tarsus less than twice middle toe with claw; naked portion of tibia shorter than middle toe with claw; toes cleft or semipalmate.
c. Tarsus scutellate in front.
d. Bill slender, with a bluntish tip; soft-skinned and sensitive throughout. SCOLOPACIDAE, CXCIII.
dd. Bill stout, hard, pointed and wedge-shaped at tip. . . . ARENARIIDAE, CXCV.
cc. Tarsus reticulate in front.
e. Bill not longer than tarsus, not compressed; contracted behind the horny tip, shaped somewhat like a pigeon's bill. . . . . CHARADRIIDAE, CXCIV.
ee. Bill longer than tarsus, much compressed at tip. . HAEMATOPODIDAE, CXCVI.

FAMILY CXCI. PHALAROPODIDAE (THE PHALAROPES)

Small, sandpiper-like birds, with the toes lobed, as in the Coots and Grebes, but the lobes narrower. Body depressed, the lower plumage thick, as in the ducks, and capable of resisting water; wings long, tail short; tarsus much compressed. Species 3, in northern regions, ranging S. in winter; size small.

a. Bill stoutish, flattened, with lancet-shaped tip; toes with the membrane scalloped. PHALAROPUS, 566.
aa. Bill subulate.
b. Toes scalloped. . . . . LOBIPES, 567.
bb. Toes plain, not scalloped. . . . . STEGANOPUS, 568.

566. PHALAROPUS Brisson (Gr., *φαλαρίς*, the coot; *πούς*, foot)

947. **P. fulicarius** (Linnaeus). RED PHALAROPE. Back black, the feathers tawny edged; top of head blackish, its sides white; rump white; quills mostly black; feet yellowish; lower parts purplish cinnamon; young white below; membrane of toes scalloped. L. 8. W. 5. T. 2¾. B. 1. Ts. ¾. Northern regions, S. through U. S. to Falkland Is. (*Eu.*) (Lat., *fulicarius*, coot-like.)

567. LOBIPES Cuvier (Lat., *lobus*, lobe; *pes*, foot)

948. **L. lobatus** (Linnaeus). NORTHERN PHALAROPE. Adult grayish black, variegated with tawny; rump and under parts white; neck largely rusty red; bill and feet black; membranes of toes scalloped. L. 7. W. 4¼. T. 2. B. ¾. Ts. ¾. Northern regions; in U. S. chiefly along seashores, S. to East Indies, and probably coast of S. Am. (*Eu.*) (Lat., *lobatus*, lobed.)

568. STEGANOPUS Vieillot (Gr., *στεγανός*, covered; *πούς*, foot)

949. **S. tricolor** Vieillot. WILSON'S PHALAROPE. Ashy above, variegated with chestnut; rump pale; lower parts white; sides of head and neck with a stripe of dark wine-red, changing to black above; tail marbled; winter plumage with no red or black; bill and feet black, membranes of toes plain. L. 9. W. 5. T. 2¼. B. 1⅓. Ts. 1¼. S. Canada, chiefly in interior; S. to Falkland Is. Largest and handsomest of the Phalaropes, varying much with the season. (Lat., *tricolor*, three-colored.)

Family CXCII. RECURVIROSTRIDAE (The Avocets)

A small family allied to the snipes, with the legs excessively long and the bill very slender, acute, straight or curved upward. Species few, in most parts of the world. *Himantopus* is said to have relatively longer legs than any other bird.

a. Toes 4; the anterior full webbed; bill recurved, flattened, tapering to a fine point; plumage beneath thickened, as in ducks; swimmers. . . . . Recurvirostra, 569.
aa. Toes 3, semipalmate; bill nearly straight, not flattened, waders. . Himantopus, 570.

569. RECURVIROSTRA Linnaeus (Lat., *recurvus*, bent upward; *rostrum*, beak)

950. **R. americana** (Gmelin). American Avocet. White, with cinnamon brown on head and neck, the wings mostly black; legs bluish. L. 18. W. 8½. T. 3½. B. 3½. Ts. 3¾. Temperate N. Am., S. to Guat. (Lat., *americanus*, American.)

570. HIMANTOPUS Brisson (Gr., *ἱμαντόπους*, a wading bird)

951. **H. mexicanus** (Müller). Black-necked Stilt. Longshanks. Lawyer. Glossy black above, white below; tail ashy; ♀ slaty; legs pink. L. 15. W. 9. T. 3. Ts. 4. B. 2½. Temperate N. Am. to Brazil. (Lat., *mexicanus*, Mexican.)

Family CXCIII. SCOLOPACIDAE (The Snipes and Sandpipers)

Bill elongate, usually longer than the head; if short, not plover-like, being soft-skinned throughout (hard when dry); nasal grooves in the form of narrow channels ranging from half to nearly the whole length of the bill; sides of lower mandible usually also grooved; nostrils narrow exposed slits; head feathered. Wings usually thin and pointed; tail short and soft; tibia rarely entirely feathered. Tarsus never entirely reticulate and usually scutellate in front and behind; hind toe present (except in *Crocethia*); front toes cleft or slightly webbed; size medium or small. Sexes alike or female slightly larger; seasonal changes in plumage often strongly marked. Eggs usually 4, placed with the small ends together in a slight nest or depression in the ground; notes various. Species mostly migratory and gregarious. Species about 90; chiefly shore birds of northern regions, but found in most parts of the world. (Gr., *σκολόπαξ*, the woodcock.)

a. Tarsus scutellate behind as well as in front; bill not strongly decurved.
b. Eyes far back, directly above the ears; bill long; tip of upper mandible thickened; plumage unchanging. (*Scolopacinae.*)
c. Tibia entirely feathered; 3 outer primaries attenuate; toes not webbed. Rubicola, 571.
cc. Tibia naked below; no attenuate primaries. . . . . Capella, 572.

bb. Eyes not far back, considerably before the ears; tip of upper mandible thin; summer and winter plumage different. (*Tringinae.*)
d. Toes not webbed at all (or with a single minute web).
e. Hind toe wanting. . . . . CROCETHIA, 573.
ee. Hind toe present.
f. Bill not shorter than middle toe with claw; (inner webs of quills not mottled).
g. Wing 6 or more; middle pair of tail feathers not produced. . CALIDRIS, 574.
gg. Wing less than 6; middle pair of tail feathers longer than the rest and more pointed.
h. Tarsus shorter than middle toe with claw, the latter shorter than bill. ARQUATELLA, 575.
hh. Tarsus longer than middle toe with claw, the toes sometimes very slender, without lateral membranes.
i. Bill scarcely longer than tarsus, not half length of tail. . PISOBIA, 576.
ii. Bill considerably longer than tarsus and more than ⅔ length of tail.
j. Tail less than 1½ times middle toe without claw; upper tail coverts mostly dusky. . . . . PELIDNA, 577.
jj. Tail 1½ times length of middle toe without claw; upper tail coverts white; bill decurved. . . . . EROLIA, 578.
ff. Bill shorter than middle toe with claw; (inner webs of quills mottled). TRYNGITES, 579.
dd. Toes more or less webbed at base.
k. Tail graduated, more than half wing. . . . . BARTRAMIA, 580.
kk. Tail not more than half wing, little graduated.
l. Tail longer than bill (from frontal feathers); gape reaching beyond base of culmen.
m. Wing less than 4; toes well webbed; both mandibles grooved to the tip; tail not barred. . . . . EREUNETES, 581.
mm. Wing not less than 4.
n. Bill narrower at tip, the upper surface hard and smooth, not grooved at tip.
o. Tarsus about as long as middle toe and claw; (wings less than 4½). ACTITIS, 582.
oo. Tarsus rather longer than middle toe and claw; (wings more than 4½).
p. Bill slender.
q. Tarsus more than 1½ times middle toe; without claw; legs yellow. TOTANUS, 583.
qq. Tarsus much less than 1½ times middle toe without claw; legs dusky. TRINGA, 584.
pp. Bill stout; (legs bluish). . . . . CATOPTROPHORUS, 585.
nn. Bill slightly broadened at tip, its upper surface slightly wrinkled or pitted. MICROPALAMA, 586.
ll. Tail shorter than bill; gape not reaching behind base of culmen; (tail barred or else chiefly black).
r. Culmen with a median groove; tip of both mandibles wrinkled or pitted. LIMNODROMUS, 587.
rr. Culmen smooth, not grooved. . . . . LIMOSA, 588.
aa. Tarsus scutellate in front, reticulate behind; bill very long, decurved. (*Numeniinae.*)
s. Bill longer than tarsus with middle toe. . . . . NUMENIUS, 589.
ss. Bill shorter than tarsus with middle toe. . . . . PHAEOPUS, 590.

571. RUBICOLA Jameson (*Philohela* Gray) (Lat., *rubus*, bramble; *incola*, an inhabitant; "born and bred in a briar bush")

952. **R. minor** (Gmelin). AMERICAN WOODCOCK. Black, brown, gray, and russet; occiput banded with blackish and rusty, below light warm brown. L. 11. W. 5. B. 3. T. 2¾. E. U. S. and S. E. Canada; W. to Colo.; in swamps. (Lat., *minor*, less.) (The EUROPEAN WOODCOCK, **Scolopax rusticola** L., a similar but considerably larger bird, is an occasional straggler to E. U. S.)

572. CAPELLA Frenzel

(Lat., *Capella*, a star in the constellation Auriga) (*Gallinago* Koch)

953. **C. gallinago delicata** (Ord). WILSON'S SNIPE. Back varied with black and bay; crown black, with a pale median stripe; breast mottled; sides barred; bill straight, very long. L. 11. W. 5. B. 2¼. T. 2⅓. N. Am. to Brazil; abundant. A favorite game bird. (Lat., *gallinago*, *gallina*, a hen; *delicatus*, dainty.)

573. CROCETHIA Billberg (*Calidris* Illiger)

(Gr., κρόκη, a pebble, in plural, the seashore; θείω, I run)

954. **C. alba** (Pallas). SANDERLING. Rusty above, marked and spotted with grayish and whitish; white on wing coverts. In winter more grayish and whitish. L. 8. W. 5. T. 2¼. B. 1. Northern regions to Patagonia; abundant coastwise. (*Eu.*) Known by its lack of hind toe. (Lat., *albus*, white.)

574. CALIDRIS Cuvier (*Tringa* of authors)

(Gr., καλίδρις, old name of some sandpiper)

955. **C. canutus rufus** (Wilson). AMERICAN KNOT. ROBIN SNIPE. Wing 6 or more; middle pair of tail feathers not longer than the rest. Brownish black, feathers edged with whitish; reddish brown below; bill straight; tarsus not shorter than middle toe and claw. L. 11. W. 6½. T. 2⅓. N. Am. to Patagonia, mostly coastwise; common. (Lat., *canutus*, to King Canute; *rufus*, reddish.)

575. ARQUATELLA Baird (Lat., diminutive of *arquatus*, for *arcuatus*, bowed).

956. **A. maritima** (Brünnich). PURPLE SANDPIPER. Ashy black, with purplish shades; feathers with pale edgings; lower parts mostly white; middle pair of tail feathers longer and more pointed than the others; bill nearly straight. L. 9. W. 5. T. 2⅔. B. 1¼. Atlantic coast, S. Greenland to Fla. (*Eu.*) (Lat., *maritimus*, maritime.)

576. PISOBIA Billberg (Gr., πῖσος, meadow; βιόω, I live)

957. **P. maculata** (Vieillot). PECTORAL SANDPIPER. JACK SNIPE. Clay-color, striped with blackish above; belly white; breast ashy-shaded and sharply streaked; rump and middle tail coverts blackish. L. 9. W. 5½. B. 1⅛. N. Am. to Patagonia; abundant. (*Eu.*, accid.) (Lat., *maculatus*, spotted.)

958. **P. fuscicollis** (Vieillot). WHITE-RUMPED SANDPIPER. Top of head buffy, streaked with black; middle tail feathers mostly black, rump dusky, the feathers bordered with pale; upper tail coverts mostly white; throat pale,

sharply streaked. L. 7½. W. 4¾. T. 2¼. N. Am. to Falkland Is. (*Eu.*, casual.) (Lat., *fuscicollis: fuscus*, dusky; *collum*, neck.)

959. **P. bairdii** (Coues). BAIRD'S SANDPIPER. In color similar to next, but larger; throat little streaked, upper median tail coverts dusky. L. 7 to 7½. W. 4⅔. T. 2¼. B. ⅞. N. Am. to Patagonia. (*Eu.*, accid.) (To Spencer Fullerton Baird.)

960. **P. minutilla** (Vieillot). LEAST SANDPIPER. PEEP. Blackish, rusty and white, much variegated; throat streaked; in winter grayish and white. Smallest of the sandpipers, resembling *Erenuetes*, but the feet different, being without webs. L. 6. W. 3½. T. 2. N. Am., S. to Chile; abundant. (*Eu.*, accid.) (Lat., *minutilla*, diminutive of *minutus*, small.)

577. PELIDNA Cuvier (Gr., πελιδνός, gray)

961. **P. alpina sakhalina** (Vieillot) DUNLIN. OX BIRD. RED-BACKED SANDPIPER. Chestnut brown above; feathers black centrally; belly, in summer, with a broad black area. L. 8½. W. 5. T. 2⅛. B. 1¾. Northern regions of N. A. and E. Asia, S. to La. and Lower Cal. (Lat., *alpinus*, alpine; *sakhalinus*, of Sakhalin Island.)

578. EROLIA Vieillot (Lat., from *Erolie*, French name of the bird)

962. **E. ferruginea** (Brünnich). CURLEW SANDPIPER. Chiefly chestnut in summer, the back black and rusty; tail coverts white; bill decurved; in winter largely brownish and streaky. L. 8. W. 5. B. 1½. Eastern Hemisphere, straggling to America from Alaska and N. S. to Patagonia. (*Eu.*) (Lat., *ferrugineus*, rusty red.)

579. TRYNGITES Cabanis (Gr., τρύγγας, an unknown bird; = Lat., *tringa;* and suffix της, having to do with)

963. **T. subruficollis** (Vieillot). BUFF-BREASTED SANDPIPER. Grayish, mottled with darker; buffy below; under primary coverts and quills with white, finely mottled with black. L. 8. W. 5½. T. 2¼. B. ⅘. N. Am., and N. E. Asia, S. to Argentina, chiefly in interior; not common. (*Eu.*) (Lat., *subruficollis: sub*, under; *rufus*, reddish; *collum*, neck.)

580. BARTRAMIA Lesson (To William Bartram, "grandfather of American ornithology")

964. **B. longicauda** (Bechstein). UPLAND PLOVER. BARTRAMIAN SANDPIPER. Light brownish, marked with ochraceous and blackish; throat whitish; tail feathers mostly marked with white. L. 12½. W. 6½. T. 4. B. 1¼. N. Am., S. to Argentina; abundant in fields, etc. (Lat., *longicauda: longus*, long; *cauda*, tail.) Allied to this species is the EUROPEAN RUFF (**Philomachus pugnax** L.) occasionally seen in E. U. S., the male with a very conspicuous ruff.

581. EREUNETES Illiger (Gr., *ἐρευνητής*, a searcher)

965. **E. pusillus** (Linnaeus). Semipalmated Sandpiper. Sandpeep. Grayish brown, often shaded with cinnamon, white below. Small. L. 6¼. W. 3¾. T. 2. B. ⅜ to ⅝. N. Am., S. to Patagonia; abundant along beaches. (*Eu.*, accid.) (Lat., *pusillus*, very little.)

966. **E. mauri** Cabanis. Western Sandpiper. Bill longer, ⅝ to 1⅛; color chiefly rusty red above; chest and breast streaked. Pacific, frequently E. (To Maur.)

582. ACTITIS Illiger (Gr., *ἀκτίτης*, a dweller on the shore)

967. **A. macularia** (Linnaeus). Spotted Sandpiper. Tip-up. Teeter-tail. Peetweet. Lustrous drab above in summer, varied with black; pure white below, with round blackish spots in adult. L. 8. W. 4. T. 2. B. 1. N. Am., S. to Brazil; everywhere, common. (*Eu.*, accid.) (Lat., *macularius*, spotted.)

583. TOTANUS Bechstein (Lat., from Ital., *Totano*, name of some bird)

968. **T. melanoleucus** (Gmelin). Greater Yellowlegs. Telltale. Ashy brown, variegated with white, etc.; bill very slender, the nasal groove not half its length; legs long, yellow. L. 12½. W. 7½. T. 3¼. B. 2¼. N. Am. to Patagonia; frequent. (Gr., *μέλας*, black; *λευκός*, white.)

969. **T. flavipes** (Gmelin). Yellowlegs. Lesser Yellowlegs. Colors as in preceding; nasal groove more than half bill; smaller; legs relatively longer. L. 11. W. 6½. T. 2½. B. 1¾. N. Am. to Patagonia; abundant. (*Eu.*, accid.) (Lat., *flavipes: flavus*, yellow; *pes*, foot.)

584. TRINGA Linnaeus (*Helodromas* Kaup)
(Lat., *tringa*, a sandpiper, from Gr., *τρύγγας*, an unknown bird)

970. **T. solitaria** Wilson. Solitary Sandpiper. Solitary Tattler. Olive brown, sparsely speckled with whitish above; below white; breast dusky. Tarsus much less than 1½ times middle toe and claw; legs dark. Bill straight and slender. L. 9. W. 5. T. 2½. B. 1¼. E. and cent. N. Am. to S. Am.; common about secluded ponds. (Lat., *solitarius*, solitary.)

585. CATOPTROPHORUS Bonaparte (Gr., *κάτοπτρον*, mirror; *φορός*, bearing)

971. **C. semipalmatus** (Gmelin). Willet. Brownish gray, varied with dusky, mostly whitish below. L. 15 or 16. W. 7⅕. T. 3. B. 2⅕. E. N. Am., N. S. to Tex., S. to Brazil; common coastwise. (Lat., *semipalmatus*, half-webbed.) The larger Western Willet, **C. s. inornatus** Brewster, W. 8, B. 2⅝. Iowa W., coming E., in migration, to Atlantic Coast, U. S., and S. to Galapagos Is. (*Eu.*, accid.) (Lat., *inornatus*, unadorned.)

586. MICROPALAMA Baird (Gr., *μικρός*, small; *παλάμη*, the palm)

972. **M. himantopus** (Bonaparte). Stilt Sandpiper. Blackish, marked with chestnut, etc.; ashy gray in winter. L. 9. W. 5. T. 2¼. B. 1¾. N. Am., S. to Chile; not common. (Gr., *ἱμαντόπους*, a wading bird.)

587. LIMNODROMUS Wied (Gr., *λίμνη*, marsh; *δρομάς*, running)

973. **L. griseus** (Gmelin). Dowitcher. Gray Snipe. Blackish and grayish; breast rusty-red in summer; nearly white in winter; bill long, nearly as in *Gallinago*. L. 11. W. 5½. T. 2½. B. 2½. E. N. Am. to Brazil; abundant coastwise. (Lat., *griseus*, gray.) A larger race with under parts more deeply colored, **L. g. scolopaceus** (Say), breeds in Alaska and migrates to South America, casually to coast of E. U. S. (Lat., *scolopaceus*, snipe-like.)

588. LIMOSA Brisson (Lat., *limosus*, muddy)

a. Tail distinctly barred.

974. **L. fedoa** (Linnaeus). Marbled Godwit. Marlin. Cinnamon brown, variegated above, nearly uniform below; no pure white; upper tail coverts cinnamon barred with black. L. 16 to 22. Ts. 3. W. 9. T. 3½. B. 4½. North-central N. Am. to Belize, British Honduras, along shores. (Lat., *fedoa*, old name of godwit, derivation unknown.)

aa. Tail black, white at base and tip.

975. **L. haemastica** (Linnaeus). Hudsonian Godwit. Brownish black and reddish, more or less variegated above and below; some white; upper tail coverts with a white band. L. 15. W. 8. Ts. 2½. B. 3½. N. Am. to Falkland Is. (Gr., *αἱματικός*, bloody.)

589. NUMENIUS Brisson (Gr., *νουμήνιος*, name of some bird, supposedly a curlew)

976. **N. americanus** Bechstein. Long-billed Curlew. Sicklebill. Cinnamon, varied with gray and blackish. Wing quills rusty cinnamon; lower parts pale cinnamon. L. 24. W. 12. T. 4. B. 5 to 9. North-central N. Am., S. to Guat. (Lat., *americanus*, American.)

590. PHAEOPUS Cuvier (Gr., *φαιός*, dusky; *πούς*, foot)

a. Secondaries and quills chiefly dusky brownish; lower parts dull buffy.

977. **P. hudsonicus** (Latham). Hudsonian Curlew. Jack Curlew. Crown with 2 broad dusky stripes, with a narrower median stripe of buffy. L. 18. W. 9½. T. 3½. B. 3 or 4. N. Am. to Chile. (*Eu.*, accid.) (Lat., *hudsonicus*, of Hudson [Bay].)

978. **P. borealis** (Forster). Eskimo Curlew. Dough-bird. Crown narrowly streaked with dusky, without paler median stripe. L. 14. W. 8. T. 3. B. 2½. N. Am., northwards, S. to Patagonia; now nearly extinct. (Lat., *borealis*, northern.)

Family CXCIV. CHARADRIIDAE (The Plovers)

Head rather large, nearly globose; bill of moderate length, shaped somewhat like a pigeon's bill, with a constriction behind the horny terminal portion; nasal fossae lined with soft skin, through which the slit-like nostrils open. Wings long and pointed, usually reaching beyond the tip of the short tail, sometimes spurred. Toes usually 3, with basal web; tarsus reticulate; tibia naked below. Sexes similar, but seasonal changes of plumage great. Species about 75, in most parts of the world, migrating far. The European Lapwing, *Vanellus vanellus* (L.), occasionally strays to our coast.

a. Plumage above speckled; below black in spring; tarsus much longer than middle toe and claw.
  b. Hind toe present, small, inserted above level of the others. . . . Squatarola, 591.
  bb. Hind toe wanting. . . . . Pluvialis, 592.
aa. Plumage not speckled; neck with dark rings; no hind toe; tarsus not much longer than middle toe and claw.
  c. Tail more than half length of wing; 2 black bars on breast. . . . Oxyechus, 593.
  cc. Tail not half length of wing; breast with one bar or none.
    d. Bill as long as middle toe with claw. . . . . Pagolla, 594.
    dd. Bill shorter than middle toe without claw. . . . . Charadrius, 595.

591. SQUATAROLA Cuvier (Venetian name of the bird)

979. **S. squatarola cynosurae** Thayer and Bangs. American Black-bellied Plover. Oxeye. Grayish, speckled; black below in breeding season, at other times white; axillars sooty-black. L. 11½. W. 7. T. 3. B. 1⅛. Ts. 2. Northern N. Am., S. to Brazil; local in U. S. (Lat., *cynosura*, the constellation at the North Pole.)

592. PLUVIALIS Brisson (Lat., *pluvialis*, rainy)

980. **P. dominica** (Müller). American Golden Plover. Frostbird. Dark and grayish above, profusely speckled, some spots bright yellow; black below in breeding season, otherwise grayish; wing coverts smoky-gray. L. 10½. W. 7½. T. 3. B. 1. Ts. 1⅔. N. Am., migrating to Argentina. A well-known game bird. (Lat., *dominicus*, of San Domingo.)

593. OXYECHUS Reichenbach (Gr., ὀξύς, sharp; ἠχώ, sound)

981. **O. vociferus** (Linnaeus). Killdeer. Grayish brown; tail with black, white, and pale rufous; a black band above the white forehead; two black bands on breast. L. 10. W. 6½. T. 4. B. ⅘, black. N. Am., abundant in the Miss. Valley; S. to Chile. (*Eu.*, accid.) Noted for its sharp notes. (Lat., *vociferus*, noisy.)

594. PAGOLLA Mathews (*Ochthodromus* Reichenbach) (Lat., from *Pago*, a Lapp name)

982. **P. wilsonia** (Ord). Wilson's Plover. Brownish gray; forehead and lower parts white, a black band on breast and one on front of crown; ♀ duller and rusty. L. 7¾. W. 4½. B. ⅝. S. N. Am., S. to Guatemala, N. to Nova Scotia, on shores. (Lat., *wilsonius*, pertaining to Alexander Wilson.)

595. CHARADRIUS Linnaeus (*Aegialitis* Boie) (Gr., χαραδριός, plover)

983. **C. semipalmatus** Bonaparte. Semipalmated Plover. Ringneck. Dark grayish brown; black bands on head and chest broad. Bill orange; black tipped, all front toes distinctly webbed at base. L. 7. W. 5. B. ½. N. Am., S. to Patagonia. (Lat., *semipalmatus*, half-webbed.)

984. **C. melodus** Ord. Piping Plover. Very pale ashy-brown, clear white below; dark bands narrow and faint; bill yellow, dark at tip; toes slightly webbed, the inner not at all. L. 6¾. W. 4⅔. B. ½. E. N. Am., S. to West Indies. (Lat., *melodus*, melodious.)

985. **C. nivosus tenuirostris** (Lawrence). Cuban Snowy Plover. Pale, with the rings faint; bill black; legs dark; outer tail feathers white. Southeast. U. S., N. to Ont., S. to Paraguay. (Lat., *nivosus*, snowy; *tenuirostris: tenius*, slender; *rostrum*, bill.)

Family CXCV. ARENARIIDAE (The Turnstones)

Toes 4, not webbed, the hinder short, well developed; tarsus scutellate in front; legs rather long; wings long and pointed; tail short; bill rather short; bill as long as tarsus, hard, sharp-pointed; tail rounded. Two species, found on most northern shores.

596. ARENARIA Brisson (Lat., *arenarius*, pertaining to sand)

986. **A. interpres morinella** (Linnaeus). Ruddy Turnstone. Variegated; black, white, and chestnut above, mostly white below, but breast black; young without reddish; feet orange; throat white. L. 8½. W. 6. T. 2½. B. ⅝. North Am., S. to Chile; generally common. (Lat., *interpres*, a go-between; *morinellus*, old name of the turnstone.)

Family CXCVI. HAEMATOPODIDAE (The Oystercatchers)

Toes 3, webbed at base; tarsus reticulate; legs stout, coarse and rough; wings long and pointed; tail short. Bill long, hard, constricted near base, much compressed, truncate at tip, nearly straight, adapted for opening shells; nasal groove short; nostril linear. Size large; sexes similar. One genus, with a few species; shore birds found in most countries.

597. HAEMATOPUS Linnaeus (Gr., *αἷμα*, blood; *πούς*, foot)

987. **H. palliatus** Temminck. American Oyster-catcher. Back dark slate; head and neck black; bill and legs red; tail coverts white. L. 18. W. 10. T. 4½. B. 3. Southeast. N. Am., N. to N. B. (casually); S. to Chile. (Lat., *palliatus*, wearing a cloak.)

Order XLIX. GALLINAE (The Gallinaceous Birds)

Bill short, stout, convex, horny, not constricted; nostrils scaled or feathered; cutting edge of upper mandible overlapping the lower. Head often partly or wholly naked, sometimes with fleshy processes. Legs moderate, stout; hind toe elevated (excepting in *Cracidae*), smaller than the other toes, sometimes wanting. Feet usually slightly webbed. Tarsus broadly scutellate (sometimes feathered), occasionally spurred in the males; claws blunt, not much curved. Wings short, strong, concave; tail various, sometimes wanting, often immensely developed. Palate schizognathous, nasal bones holorhinal; basipterygoid processes present. Precocial, often polygamous, terrestrial in habit and hence sometimes called *Rasores* or Scratchers.

A large order including the chief game birds of most countries, as well as most kinds of domesticated fowls. The Hen (*Gallus gallus*), the Guinea Hen (*Numida meleagris*), and the Peacock (*Pavo cristatus*), are familiar examples of the order. (Lat., *gallus*, a cock.)

Families of Gallinae

a. Hind toe short, small, inserted above level of the others.
b. Tarsus without spurs; head mostly feathered, tail not vaulted.
c. Tarsus bare, scutellate, nostrils not feathered. Size small. (Quails.) Odontophoridae, CXCVII.
cc. Tarsus and nostrils more or less feathered. (Grouse.) . Tetraonidae, CXCVIII.
bb. Tarsus spurred in the male; head with much naked, highly colored skin; tail vaulted. Size large. (Turkeys.) . . . . . Meleagrididae, CXCIX.

Family CXCVII. ODONTOPHORIDAE (The Quails)

Small pheasants, with the tarsus bare, scutellate, the nostril unfeathered with a naked scale; tarsus without spurs; hind toe short, inserted above level of the others. Species about 40, American, valued as game birds and charming for their soft colors and amiable nature. (Gr., *ὀδούς*, tooth; *φορός*, bearing.)

a. Head not crested; lower mandible with its cutting edge serrate towards the tip. Colinus, 598.

598. COLINUS Goldfuss (Lat., from French, *colin*)

988. **C. virginianus** (Linnaeus). Bobwhite. Quail (North). Partridge (South). No crest; forehead, line through eyes, chin, and throat white, deep buff in ♀; crown dark; plumage generally chestnut red above, barred

and streaked; white, barred with black below. L. 9½. W. 5. T. 3. B. ⅜. E. U. S., W. to Great Plains; abundant. (Lat., *virginianus*, of Virginia.) The smaller European Quail, **Coturnix coturnix** (Linnaeus), with very short tail and lower mandible entire, has been introduced E. Numerous other native genera, mostly crested, occur W. and S. W.

Family CXCVIII. **TETRAONIDAE** (The Grouse)

Hind toe small, short; tarsus without spurs, more or less feathered; head well feathered, nostrils feathered; tail not vaulted. Species about 20. Game birds; abounding in northern regions; largely American. (Lat., *tetrao*, grouse.)

a. Tarsus feathered about half way to the toes; tail fan-shaped, of 18 broad, soft feathers; neck with a ruff. . . . . Bonasa, 600.
aa. Tarsus feathered to the toes.
b. Tail more than half of wing, rounded or even; no ruff or peculiar feathers on neck.
c. Toes naked; plumage not white. . . . . Canachites, 599.
cc. Toes feathered; winter plumage chiefly snow-white, with some black quills. Lagopus, 601.
bb. Tail about half as long as wing; toes naked.
d. Neck with a ruff of straight stiff feathers, beneath which is a bare, inflatable air sac; tail rounded. . . . . Tympanuchus, 602.
dd. Neck without peculiar feathers; tail graduated, the middle feathers exserted. Pedioecetes, 603.

599. **CANACHITES** Stejneger (Gr., καναχέω, I make a noise.)

989. **C. canadensis canace** (Linnaeus). Canada Grouse. Spruce Partridge. Black above with grayish markings; mostly black below with white spots; sides streaked; tail black, tipped with reddish; ♀ smaller, black interrupted or streaky. Tail of 16 feathers; no evident air sac on side of neck. L. 16. W. 6¾. T. 5½. Spruce swamps, S. E. Canada and Northeast. U. S.; S. to N. Y. and Mich. (Lat., *canadensis*, of Canada; *Canace*, daughter of Aeolus.)

600. **BONASA** Stephens (Gr., βόνασος, wild ox)

990. **B. umbellus** (Linnaeus). Ruffed Grouse. Partridge (North). Pheasant (South). Crested; sides of neck with a ruff of soft dark feathers; color reddish or grayish brown, much streaked and variegated with blackish and pale. L. 18. W. 7¼. T. 7. E. U. S., except the most northern part; in woodlands. (Lat., *umbella*, umbrella.) Another race, **B. u. togata** (Linnaeus) is darker, more grayish above. It ranges from N. E. U. S. to S. E. Canada. (Lat., *togatus*, wearing the toga.) Still another, **B. u. thayeri** Bangs, has nearly the whole under surface barred. Nova Scotia. (To John E. Thayer.)

601. **LAGOPUS** Brisson (Gr., λαγώπους, the ptarmigan)

991. **L. lagopus albus** (Gmelin). Willow Ptarmigan. White Ptarmigan. Fore parts cinnamon brown, variegated with blackish, rest of body chiefly

white; winter plumage pure white, some black quills on tail; bill stout. L. 16. W. 8. T. 5. Arctic regions of N. Am.; S. to N. Y. in winter. Some other species occur N. and W. (Lat., *albus*, white.)

602. TYMPANUCHUS Gloger (Lat., *tympanum*, drum; *nucha*, nape)

a. Scapulars without conspicuous terminal whitish spots; neck tufts in ♂ of more than 10 parallel-edged, obtuse feathers.

992. **T. americanus** (Reichenbach). PRAIRIE CHICKEN. PRAIRIE HEN. PINNATED GROUSE. Sides of neck with a tuft of long rounded feathers, beneath which is a patch of bare, red skin, capable of great inflation; color black, tawny, and white, much barred and streaked. L. 17. W. 9. T. 4½. ♀ smaller. Prairies, etc., Saskatchewan to Ark., E. to Ohio; nearly exterminated eastward. (Lat., *americanus*, American.)

aa. Scapulars with conspicuous terminal whitish spots; neck tufts in ♂ of not more than 10 lanceolate pointed feathers.

993. **T. cupido** (Linnaeus). HEATH HEN. Rather smaller and darker; with pointed ruff feathers. W. 8½. E. U. S., once from Mass. to Va., now extinct, except on Marthas Vineyard. (Lat., *Cupido*, Cupid, the ruff on the neck likened to Cupid's wings.)

603. PEDIOECETES Baird (Gr., πεδίον, a plain; οἰκέτης, inhabitant)

994. **P. phasianellus campestris** Ridgway. SHARP-TAILED GROUSE. Streaked and spotted, yellowish brown, black, and white above; white, marked with dark brown below; sexes alike. L. 18. W. 8¾. T. 5. Central-southern Canada and central-northern U. S., S. to Kans. and N. Ill. (Diminutive of Lat., *phasianus*, pheasant; *campestris*, relating to a plain.)

FAMILY CXCIX. MELEAGRIDIDAE (THE TURKEYS)

A small family of *Gallinae*, differing as a whole from the *Tetraonidae* in having the tarsus in the ♂ armed with a spur. The head is naked, the tail is long, broad, and vaulted. The 2 species of *Meleagris* are American. Allied to the Old World family of *Phasianidae*, or pheasants, birds remarkable in form and coloration, some of them already introduced into the United States.

604. MELEAGRIS Linnaeus (Gr., μελεαγρίς, the guinea fowl)

995. **M. gallopavo silvestris** Vieillot. WILD TURKEY. Head and neck unfeathered, with scattered hairs, and with red caruncles; forehead with a long fleshy process; tail long, broad, truncate; plumage metallic; breast in ♂ with a tuft of bristles. Glossy, coppery black, tips of upper tail coverts and of tail feathers chestnut. L. 48. W. 21. T. 18½. ♀ smaller, duller. E. U. S., once ranging from Ontario and New England to the Rocky Mts. and south-

ward, now extinct N. The domestic Turkey is descended from the typical Mexican variety, **M. gallopavo** (Linnaeus).[1] (Lat., *gallus*, cock; *pavo*, peafowl; *silvestris*, of woodland.)

Order L. COLUMBAE (The Doves)

Bill straight, compressed, the horny tip separated by a constriction from the soft part. Nostrils opening beneath a soft, tumid membrane or cere, at base of bill. Frontal feathers sweeping in a strongly convex outline across base of upper mandible; tomiae meeting. Hind toe on a level with the rest (except in *Starnoenas*, etc.), the others usually not webbed. Tarsus mostly scutellate in front, elsewhere reticulate, the plates soft. Head small, skull schizognathous, the nasal bones schizorhinal; basipterygoids present. Plumage soft, compact, the feathers very loosely inserted. Altricial; monogamous.

A small order, including some extinct forms, closely related to the *Gallinae*. The principal family is the *Columbidae*. (Lat., *columba*, dove.)

Families of Columbae

a. Wings and tail well developed. . . . . Columbidae, CC.

Family CC. COLUMBIDAE (The Pigeons)

Wings long, pointed; tail never forked, of 12 or 14 feathers; plumage compact, the feathers loosely inserted. Species numerous, found in most regions, but most abundant in the East Indies. Besides the following, a number of pigeons occur in the Southern states. The common domestic dove (*Columba oenas* Linnaeus) is a fair type of the family.

a. Tarsus feathered at the suffrago, shorter than the lateral toes. (*Columbinae.*)
b. Tail very long, wedge-shaped, of 12 pointed feathers. . . . . Ectopistes, 605.
aa. Tarsus entirely bare, scutellate, longer than the lateral toes. (*Zenaidinae.*)
c. Tail long, pointed, of 14 pointed feathers, its length more than ⅔ wing. Zenaidura, 606.
cc. Tail short, rounded, of 12 broad feathers; less than ⅔ wing. . . Chaemepelia, 607.

605. ECTOPISTES Swainson (Gr., ἐκτοπιστής, wanderer)

996. **E. canadensis** (Linnaeus). Passenger Pigeon. Bluish drab, with reddish and violet tinges, reddish below; ♀ less reddish. L. 17. W. 7½. T. 8. Cent. and east. N. A., S. to E. Mex.; gregarious. Once inordinately abundant, but now absolutely extinct. (Lat., *canadensis*, of Canada.)

606. ZENAIDURA Bonaparte (*Zenaida*, a related genus; οὐρά, tail; *Zenaida* was named from Madame Zénaïde Bonaparte)

997. **Z. macroura carolinensis** (Linnaeus). Mourning Dove. Turtle Dove. Brownish olive, glossed with blue and wine color; plumage with

[1] The account of the habits of the Turkey given by Linnaeus is worth quoting: "Mas exaestuat inflato pectore, expansa cauda, sanguinea facie, relaxata frontis caruncula; irae tenax; sapida caro."

metallic luster; a dark ear spot; outer tail feathers with white; ♀ duller. L. 12. W. 5¾. T. 6¾. Eastern N. Am., N. to southeastern Canada; very abundant, feeding on the ground, its mournful note not an index to its merry disposition. (Gr., *μακρός*, long; *οὐρά*, tail; Lat., *carolinensis*, of Carolina.) The western form, **Z. m. marginella** (Woodhouse) is paler. It ranges from Pacific Coast to Mississippi Valley. (Lat., *marginellus*, diminutive of *margo*, a border.)

607. CHAEMEPELIA Swainson (Gr., *χαμαί*, on the ground; *πέλεια*, dove)

998. **C. passerina** (Linnaeus) Ground Dove. Grayish olive, with bluish gloss; the head, neck, and breast wine-color in ♂. L. 6¼. W. 3¼. T. 2¾. Southeastern U. S., N. to N. Y.; common southward. (Lat., *passerinus*, like a sparrow.)

Order LI. RAPTORES (The Birds of Prey)

Bill powerful, cered at base, strongly hooked at the end. Feet never zygodactyie; 4th toe sometimes versatile; hind toe developed, elevated or not; claws very strong in typical forms, weak in the American vultures; tibia, and often tarsus, feathered. Primaries 10; tail feathers usually 12. Altricial, but young downy at birth. Carnivorous birds, often of large size and great strength, found in every part of the world. Some of them feed upon carrion, some of the smaller on insects, and some on reptiles or fishes; but the most of them feed on mammals and birds, which are captured in open warfare. (Lat., *raptor*, robber.)

Families of Raptores

a. Head entirely naked (downy in young); hind toe short, elevated; claws small; inner toe somewhat webbed; nostril longitudinal. (American Vultures.)
Cathartidae, CCI.

aa. Head nearly or quite fully feathered; hind toe not elevated, its claw large and strong, like the others; inner toe not webbed; nostrils vertical or roundish.

b. Eyes lateral, not surrounded by a disk of radiating feathers; cere exposed.

c. Outer toe not reversible; claws graduated, from the largest (hind toe) to the smallest (outer toe).

d. Nostrils not circular, nor with an inner bony tubercle. (Hawks.)
Accipitridae, CCII.

dd. Nostrils small, circular, each with a central bony tubercle; cutting edge of upper mandible (in our species) with a strong tooth, separated from the hooked tip of the bill by a distinct notch; tarsus reticulated all around. (Falcons.)
Falconidae, CCIII.

cc. Outer toe reversible; claws all of equal length, narrowed and rounded on lower side; tarsus reticulate. (Fish Hawks.) . . . . . Pandionidae, CCIV.

bb. Eyes directed forward, surrounded by disks of radiating feathers; cere concealed by bristly feathers; outer toe reversible. (Owls.)

e. Facial disk sub-triangular; middle claw pectinate. . . . . Tytonidae, CCV.

ee. Facial disk sub-circular, middle claw not pectinate. . . . . Strigidae, CCVI.

Family CCI. CATHARTIDAE (The New World Vultures)

Head and part of neck bare. Eyes lateral; ears small. Bill lengthened, weak, and but little hooked; nostrils perforate. Wings very long and strong, giving a strength and grace of flight which few other birds possess. Hind toe short, and elevated; front toes long, somewhat webbed, with rather weak and straightish claws. Large turkey-like raptores, without the strength and spirit of the hawks and owls. "Voracious and indiscriminate gormandizers of carrion and animal refuse of all sorts, hence efficient and almost indispensable scavengers in the warm countries where they abound." (Coues.) The vultures are practically voiceless. On the ground they walk rather clumsily; when disturbed, they eject the fetid contents of their capacious crops. Two species, the Condor and the California Vulture, are among the largest birds of flight in the world. The few species are American, the Old World Vultures (*Aegypiidae*) being vulture-like hawks.

a. Wings very long, primaries reaching to end of tail or farther; tail rounded; nostrils large and broad. . . . . Cathartes, 608.
aa. Wings short, scarcely reaching middle of tail; tail truncate; nostrils small and narrow. Coragyps, 609.

608. CATHARTES Illiger (Gr., *καθαρτής*, purifier)

999. **C. aura septentrionalis** Wied. Turkey Vulture. Turkey Buzzard. Black, lustrous above and somewhat mottled with brown; skin of head and neck red. L. 30. W. 22. T. 12. N. Am., N. to S. Canada; abundant, especially S. and S. W. (*aura*, South American name of the bird; Lat., *septentrionalis*, northern.)

609. CORAGYPS Geoffroy (Gr., *κόραξ*, raven; *γύψ*, vulture)

1000. **C. urubu** (Vieillot). Black Vulture. Carrion Crow. Uniform dull black. L. 24. W. 17. T. 8. Southeastern U. S., S. to Southern S. Am., straying N. to Quebec. A heavier bird than the Turkey Buzzard, although shorter. (*urubu*, South American name.)

Family CCII. ACCIPITRIIDAE (The Hawks)

Head fully feathered; no ear tufts. Eyes lateral; eyelids provided with lashes; usually a projecting bony eyebrow; no complete facial disk; nostrils not circular, nor with an inner bony tubercle. Toes always naked, and usually tarsus also; hind toe not elevated, outer toe not reversible; claws very strong and sharp, graduated as to length from the longest (hind toe) to the shortest (outer toe). Bill stout, strongly hooked, its base not hidden by feathers. Plumage usually of blended colors, barred or streaked; changes considerable; ♀ usually the larger. Species numerous, occurring everywhere.

a. Tarsus naked, reticulate all around, much shorter than tibia.
b. Tail very deeply forked. . . . . ELANOIDES, 610.
bb. Tail merely emarginate; claws not grooved beneath. . . . . ELANUS, 611.
aa. Tarsus not reticulate all around; claws grooved beneath.
c. Tarsus decidedly shorter than tibia.
d. Tarsus scutellate in front only, not fully feathered.
e. Toes somewhat webbed at base; cutting edge of upper mandible notched. ICTINIA, 612.
ee. Toes not webbed at all; neck feathers lanceolate. Size very large. (Fish Eagles.) HALIAEETUS, 613.
dd. Tarsus almost or quite entirely feathered.
f. Tarsus densely feathered all around down to base of toes. Size very large. AQUILA, 614.
ff. Tarsus densely feathered to base of toes except a bare strip behind. BUTEO, 615.
ddd. Tarsus scutellate in front and behind.
g. Wing rather pointed, more than 4 times length of tarsus. . . . . BUTEO, 615.
gg. Wing rounded, less than 4 times length of tarsus. . . . . ASTURINA, 616.
cc. Tarsus about as long as tibia.
h. Face without ruff; wings rounded, little longer than tail; tarsus scutellate in front only, rarely booted.
i. Tarsus feathered less than ⅓ of the way down in front, the feathers well separated behind. L. 12 to 18. . . . . ACCIPITER, 617.
ii. Tarsus feathered about half way down in front, the feathers scarcely separated behind. L. 24. ASTUR, 618.
hh. Face with a slight ruff, somewhat as in owls; wings very long, longer than the long tail; tarsus scutellate in front and behind. . . . . CIRCUS, 619.

610. ELANOIDES Vieillot (Lat., *elanus*, a kite; Gr., *εἶδος*, appearance)

1001. **E. forficatus** (Linnaeus). SWALLOW-TAILED KITE. Lustrous black; head, neck, lower parts, and band on rump white; young streaky. L. 25. W. 17. T. 14. Southeastern U. S., S. to Paraguay, N. to Ontario and Wisc. (*Eu.*, accid.) (Lat., *forficatus*, forked, from *forfex*, shears.)

611. ELANUS Savigny (Lat., *elanus*, a kite)

1002. **E. leucurus majusculus** Bangs & Penard. WHITE-TAILED KITE. Bluish gray, with white on head and tail, and black on shoulder. L. 17. W. 13. T. 7. British Honduras and Guatemala. N. to Calif., Tex., and S. C.; accid. to S. Ill. (Gr., *λεύκουρος*, white-tailed; Lat., *majusculus*, somewhat greater.)

612. ICTINIA Vieillot (Gr., *ἰκτῖνος*, kite)

1003. **I. misisippiensis** (Wilson). MISSISSIPPI KITE. Chiefly plumbeous; wings with chestnut. D. 15. W. 12. T. 6½. Southeastern U. S., N. to Pa. and Wisc., S. to Guat. (Lat., *mississippiensis*, of Mississippi.)

613. HALIAEETUS Savigny (Gr., *ἁλιάετος*, a sea eagle)

1004. **H. leucocephalus** (Linnaeus). BALD EAGLE. AMERICAN EAGLE. Dark brown; head, neck, and tail white (after the 3d year), dusky in the

young; bill and feet yellow. L. 36. W. 25. T. 14. N. Am.; everywhere more abundant coastwise. "Common, for an eagle; a piratical parasite of the Osprey, otherwise notorious as the emblem of the Republic." (Coues.) (Gr., λευκός, white; κεφαλή, head.)

614. AQUILA Brisson (Lat., *aquila*, eagle)

1005. **A. chrysaetos canadensis** (Gmelin). American Golden Eagle. Glossy dark brown; head and neck paler, tawny brown; quills blackish; tail clouded, with whitish at base. L. 36. W. 25. T. 16. North Am., S. to cent. Mex., less common than the Bald Eagle eastward, but more abundant W. (Gr., χρυσός, gold; ἀετὸς, eagle; Lat., *canadensis*, Canadian.)

615. BUTEO Lacépède (Lat., *buteo*, buzzard, as these hawks are called in England)

a. Bill small and weak, its gape, from corner to corner, 1¾ inches. (*Archibuteo* Brehm.)

1006. **B. lagopus sanctijohannis** (Gmelin). American Rough-legged Hawk. Chiefly whitish, rusty streaked; but sometimes entirely black. L. 24. W. 18. T. 10. North Am., S. to Texas. (Gr., λαγώπους, rough-footed, like a hare; Lat., *sanctijohannis*, of St. Johns [N. F.].)

aa. Bill strong, the gape 1¾ inches wide from corner to corner of mouth (*Brewsteria* Maynard)

1007. **B. regalis** (Gray). Rusty brown, marked with gray, white, and black; sometimes plain dark chocolate-brown. L. 23. W. 17. T. 10. W. N. Am., E., casually to N. C. (Lat., *regalis*, kingly.) (*A. ferrugineus* Lichtenstein.)

a. Outer web of primaries without white, buffy, or ochraceous spots.
b. Four outer primaries emarginate on inner web.

1008. **B. borealis** (Gmelin). Red-tailed Hawk. "Hen Hawk." Red-tailed Buzzard. Dark brown, much barred and streaked; tail in adult bright chestnut red above, with a narrow black bar near its tip. L. 23. W. 15½. T. 8½. E. N. Am.; common. (Lat., *borealis*, northern.) Replaced on Great Plains by Krider's Hawk, **B. b. kriderii** Hoopes, with lower parts extensively white, and little or no buffy or reddish colors on body. (To John Krider.)

bb. Three outer primaries emarginate on inner web.
c. Wing more than 13.

1009. **B. swainsoni** Bonaparte. Swainson's Hawk. Gray, variously streaked, usually a chestnut or brownish area on breast; wings dusky; tail with 9 or 10 narrow dark bars; variable, sometimes wholly dark brown. L. 20. W. 16. T. 8½. W. N. Am., E. to Quebec and Mass. (To William Swainson.)

cc. Wing less than 12.

1010. **B. platypterus** (Vieillot). Broad-winged Hawk. Brown above, whitish or fulvous below, variously streaked and barred; conspicuous dark cheek patches; tail with broad dark bands alternating with narrower pale ones, white-tipped; lower parts brownish with whitish spots; in young whitish with darker streaks. L. 18. W. 11. T. 7. E. N. Am., S. to Peru. A handsome but relatively small hawk. (*platypterus:* Gr., πλατύς, broad; πτερόν, wing.)

1011. **B. lineatus** (Gmelin). Red-shouldered Hawk. Red-shouldered Buzzard. Dark reddish brown; head and neck more or less rusty; bend of wing reddish brown in adult; tail with several white bars; young much streaked below and with little reddish. L. 22. W. 14. T. 9. Considerably lighter in weight than the red-tailed hawk, although nearly as long. E. N. Am.; abundant. (Lat., *lineatus*, lined.) A subspecies, **B. l. alleni,** Florida Red-shouldered Hawk, is smaller and paler. Southeastern U. S., N. to S. Ill. (To J. A. Allen.)

616. ASTURINA Vieillot (Lat., *astur*, a hawk)

1012. **A. plagiata** Schlegel. Mexican Goshawk. Chiefly dark ashy gray, white below, finely barred with dark gray; wings and tail black, with white markings; upper tail coverts white. L. 18. W. 10. T. 7½. Cent. Amer. and Mexico, straying to S. Ill. (Lat., *plagiatus;* from *plagio*, I steal.)

617. ACCIPITER Brisson (Lat., *accipiter*, a hawk)

1013. **A. velox** (Wilson). Sharp-shinned Hawk. "Pigeon Hawk." Tail truncate; tarsus sometimes "booted"; general color bluish gray; breast, sides, etc., whitish, barred with reddish brown. L. 12. W. 7. T. 6. N. Am.; S. to Panama; abundant. A small but courageous hawk. The species of this genus are more destructive among poultry than any other of our hawks. (Lat., *velox*, swift.)

1014. **A. cooperii** (Bonaparte). Cooper's Hawk. Chicken Hawk. Tail rounded; tarsus never booted; colors similar, more bluish, the top of head darker, the tail more plainly white-tipped. L. 18. W. 10. T. 8. Temperate N. Am., S. to Costa Rica; common. (To William Cooper.)

618. ASTUR Lacépède (Lat., *astur*, a hawk)

1015. **A. gentilis atricapillus** (Wilson). American Goshawk. Chiefly slate-blue with white superciliary stripe; lower parts white, finely barred with brown; tail with 4 dark bars. L. 24. W. 14. T. 11. North Am., S. to Va. in winter. (*Eu.*, accid.) (Lat., *gentilis*, belonging to the same clan; *atricapillus*, black-haired.)

619. CIRCUS Lacépède (Gr., κίρκος, a kind of hawk)

1016. **C. cyaneus hudsonius** (Linnaeus). Marsh Hawk. ♂ Chiefly pale bluish gray; rump and under parts whitish; tail bluish, mottled and tipped with white, and with dark bands; dusky brown. ♀ brown. L. 18. W. 15. T. 9. N. Am., S. to Colombia; abundant. Readily known by the white rump. (Lat., *cyaneus*, dark blue; *hudsonius*, of Hudson [Bay].)

Family CCIII. FALCONIDAE (The Falcons)

This family is distinguished from the more plebeian hawks and eagles (*Accipitriidae*) by the structure of the bill. The nostril is small, circular, with a conspicuous bony tubercle. In many of the genera the cutting edge of the upper mandible has a strong tooth which is separated from the hooked tip of the bill by a deep notch. Tarsus reticulate all around. Birds of varying size, closely related, all of them remarkable for courage and a certain dignity. Even the smallest is clearly a Falcon.

a. Tarsal scales all small; usually only first primary emarginate; sexes colored alike. Falco, 620.

aa. Tarsal plates in front enlarged, appearing like scutella; two primaries emarginate on inner web; sexes not colored alike. . . . . Cerchneis, 621.

620. FALCO Linnaeus (Lat., *falco*, a falcon)

a. Only first primary emarginate on inner web; sexes colored alike.

b. Tarsus longer than middle toe and claw. (*Hierofalco* Cuvier.)

c. Tarsus feathered in front more than half way down.

1017. **F. rusticolus candicans** Gmelin. American Gyrfalcon. Bluish gray or white above, with dark bands; lower tail coverts with ashy; young plain above, streaky below. L. 24. W. 16. T. 10. Arctic regions, S. to N. U. S. in winter. (Lat., *rusticolus: rusticus*, rural; *incola*, an inhabitant; *candicans*, being white.) Subsp. **F. r. obsoletus** Gmelin occurs in Labrador, S. to N. E. U. S. in winter. This form is darker, the lower parts chiefly dusky. (*Eu.*) (Lat., *obsoletus*, obsolete.)

cc. Tarsus not feathered half way down in front.

1018. **F. mexicanus** Schlegel. Prairie Falcon. Grayish brown, more or less barred and streaked. L. 18. W. 14. T. 8. S. W. Canada, S. to S. Mexico, E. to Ill. Allied to the lanner of Europe. (Lat., *mexicanus*, Mexican.)

bb. Tarsus not longer than middle toe, scarcely feathered below heel joint. (*Rhynchodon* Nitzsch.)

1019. **F. peregrinus anatum** Bonaparte. Duck Hawk. Peregrine Falcon. Dark ash, with paler waves; top of head black; pale below, barred

or streaked; black cheek patches. L. 16. W. 13. T. 7. North Am., S. to S. Am.; not very common. (Lat., *peregrinus*, wandering; *anatum*, genitive plural of *anas*, a duck.)

aa. Two primaries emarginate. (*Tinnunculus* Vieillot.)

1020. **F. columbarius** Linnaeus. Pigeon Hawk. American Merlin. Tarsus about equal to middle toe; basal joints of toes with small hexagonal scales. Ashy blue or brownish above with darker streaks; lower parts whitish or buffy, streaked with brown; middle tail feathers in ♂ with about 4 black bands; in ♀ with about 5 pale bands. L. 13. W. 8. T. 5. N. Am. to Ecuador. (Lat., a dove keeper.) A paler subspecies, **F. c. richardsonii** Ridgway, inhabits Western U. S., E. to N. Dak. (To John Richardson.)

621. CERCHNEIS Boie (Gr., κερχνηίς, the kestrel, a small European falcon)

1021. **C. sparveria** (Linnaeus). American Sparrow Hawk. Tarsus longer than middle toe; basal joints of toes with transverse scutella. Back tawny; wings bluish and black in ♂; 7 black blotches about head; tail chestnut with a broad black band in ♂, and a narrow terminal one of white; below white or tawny, often with black spots. ♀ different, more streaky, the tail tawny, with numerous narrow darker bars; back and wing coverts rusty, barred with black. One of the most active and courageous of the hawks, a genuine falcon in structure and temper, though nearer sparrow size. L. 11. W. 7. T. 5. N. Am., S. to Costa Rica; abundant. (Lat., *sparverius*, pertaining to a sparrow.)

Family CCIV. PANDIONIDAE (The Ospreys)

The fish hawks are distinguished from other hawks by the reversible outer toe, and by the practically equal length of the 4 claws. They feed upon fishes and are very often robbed by larger hawks, especially the Bald Eagle.

622. PANDION Savigny (Gr., Πανδίων, a king of Athens)

1022. **P. haliaetus carolinensis** (Gmelin). American Osprey. Fish Hawk. Dark brown; tail grayish, with narrow dark bars; head, neck, and lower parts mostly white; ♀ with the breast more spotted; feet very large. L. 24. W. 20. T. 10. In most parts of N. Am., S. to Paraguay, about water; an expert fisher. (Gr., ἁλιάετος, a sea-eagle; Lat., *carolinensis*, of Carolina.)

Family CCV. TYTONIDAE (The Barn Owls)

A small family including those owls which have long faces, the facial disk being complete and subtriangular. All these have the sternum entire behind, with a central emargination, the furculum grown fast; the middle and inner

toes are about equal in length, and the middle claw pectinate below. Species few, chiefly of Asia and Europe.

a. Wings long, pointed, reaching beyond tail when folded; no ear tufts; tarsus scant-feathered; bill pale; eyes black. . . . . TYTO, 623.

623. TYTO Billberg (*Aluco* Fleming) (Gr., τυτώ, an owl)

1023. **T. alba pratincola** (Bonaparte). AMERICAN BARN OWL. White and tawny, of various shades, very finely mottled, streaked, and dotted with darker; below pale, with some spots. L. 17. W. 13. T. 5½. U. S., N. to S. Ont., S. to S. Mex., chiefly S. and W. A handsome, solemn-looking owl. (Lat., *albus*, white; *pratincola: pratum*, meadow; *incola*, inhabitant.

FAMILY CCVI. STRIGIDAE (THE OWLS)

Head very large, shortened lengthwise and greatly expanded laterally, the eyes directed forwards and partly surrounded by a more or less complete circular disk of radiating feathers of peculiar texture; loral feathers antrorse, long and dense; feathers on the sides of forehead often elongated into ear-like tufts. Plumage very soft and lax, rendering the flight almost noiseless; its colors blended and mottled so as to baffle description; no red, blue, yellow, or green. External ear very large, often provided with a movable flap. Outer toe reversible; claws very sharp, long, and strong; inner toe shorter than middle; middle claw not pectinate. Sternum double notched or fenestrate; furculum free. Eggs nearly spherical, pure white. Chiefly nocturnal. Sexes colored alike, ♀ usually the larger. Owls are found in every part of the globe, and most of the species have a wide range. Their habits are too well known to need notice here.

a. Tarsus fully feathered.
  b. Eye in the center of a nearly complete circular disk; external ear larger than eye, with a well-developed opercle.
    c. Ear tufts present, sometimes very short; cere longer than rest of culmen; iris yellow. ASIO, 624.
  cc. Ear tufts not evident; cere short.
    d. Tail about ⅔ wing.
      e. Eyes not small, the iris dusky; 5 outer primaries emarginate. . . STRIX, 625.
      ee. Eyes rather small, the iris yellow; 6 outer primaries sinuate; bill small. SCOTIAPTEX, 626.
    dd. Tail short, nearly even, about ½ wing; iris yellow. . . . CRYPTOGLAUX, 627.
  bb. Eye nearer top than bottom of a more or less incomplete disk; external ear not larger than eye, without developed opercle; iris yellow.
    f. Head with very conspicuous ear tufts.
      g. Tail about ½ wing; bill pale. . . . . OTUS, 628.
      gg. Tail about ⅔ wing; bill blackish. . . . . BUBO, 629.
    ff. Head without evident "ear tufts" (these rudimentary in *Nyctea*).
      h. Tail rounded; plumage chiefly white. . . . . NYCTEA, 630.
      hh. Tail graduated; plumage not white. . . . . SURNIA, 631.
aa. Tarsus nearly naked, its length more than twice middle toe; facial disk imperfect; no ear tufts. . . . . SPEOTYTO, 632.

624. ASIO Brisson (Lat., *asio*, a horned owl)

a. Ear tufts well developed, of 8 to 12 feathers.

1024. **A. otus wilsonianus** (Lesson). American Long-eared Owl. One primary emarginate on inner web. Dusky, more or less mottled and streaked with buffy and grayish, much variegated below. L. 15. W. 12. T. 6. Temperate N. Am., S. to S. Mex.; often using deserted crow's nests. (Lat., *otus*, the horned owl; *wilsonianus*, of [Alexander] Wilson.)

aa. Ear tufts inconspicuous, few-feathered.

1025. **A. flammeus** (Pontoppidan). Short-eared Owl. Two outer primaries usually emarginate on inner webs. Buffy whitish, striped with dark brown, the dark streaks narrower below. L. 15. W. 12. T. 6. N. Am., S. to Guatemala; not rare in parts of U. S. (*Eu.*) (Lat., *flammeus*, flame-colored.)

625. STRIX Linnaeus (*Syrnium* Savigny) (Lat., *strix*, a screech owl)

1026. **S. varia** Barton. Barred Owl. Toes not concealed by long feathers. Olive brown, barred with white above; breast similarly barred; belly streaked. L. 18. W. 14. T. 9. E. N. Am., S. to N. Ga.; common. The most noisy of our Owls, but rather mild in temper. (Lat., *varius*, different.)

626. SCOTIAPTEX Swainson (Gr., σκοτία, darkness; πτύγξ, the eagle owl)

1027. **S. nebulosa** (Forster). Great Gray Owl. Spectral Owl. Toes concealed by long feathers. Ashy brown above, waved with white; breast streaked, belly barred. L. 30. W. 18. T. 12. Northern N. Am., occasionally S. in winter to N. J. and Nebr. A huge bird, one of the largest of owls. (Lat., *nebulosus*, dark.)

627. CRYPTOGLAUX Richmond (Gr., κρυπτός, hidden; γλαύξ, name of some owl)

1028. **C. funerea richardsoni** (Bonaparte). Richardson's Owl. Bill yellow; cere not tumid; nostrils obliquely oval, opening laterally. Chocolate brown, striped with white; below white, striped with brown. L. 10. W. 7¼. T. 4½. Northern N. Am., S. to N. U. S. (Lat., *funereus*, dismal; *richardsoni*, to John Richardson.)

1029. **C. acadica** (Gmelin). Saw-whet Owl. Bill black; cere tumid; nostrils nearly circular, opening anteriorly. Color similar, less white above, more reddish below. L. 8. W. 5¾. T. 2¾. Temperate N. Am., S. to La. and Guatemala. (Lat., *acadicus*, of Acadia.)

628. OTUS Pennant (*Megascops* Kaup) (Lat., *otus*, a horned owl)

1030. **O. asio naevius** (Gmelin). Screech Owl. Red Owl. Grayish, streaked, and barred, or else with the grayish replaced by bright reddish; these two different styles of plumage about equally common and bearing no relation to age, sex, or season. L. 10. W. 7. T. 3½. E. N. Am., from S. E. Canada to N. C. (*Eu.* accid.) Our commonest owl, small and active. (Lat., *asio*, a horned owl; *naevius*, spotted.)

629. BUBO Duméril (Lat., *bubo*, a horned owl)

1031. **B. virginianus** (Gmelin). Great Horned Owl. Black, gray, and buffy, variously mottled and barred; usually a whitish half-collar; ear tufts large, their feathers mostly black. L. 22. W. 16. T. 10. S. E. Canada to Fla. and Tex. (*Eu.* accid.). Common. One of the strongest and most courageous of the owls. (Lat., *virginianus*, of Virginia.) Represented W. of Iowa by a paler form, subsp. **B. v. occidentalis** Stone. (Lat., *occidentalis*, western.)

630. NYCTEA Stephens (Gr., *νυκτεύς*, nocturnal)

1032. **N. nyctea** (Linnaeus). Snowy Owl. Pure white, more or less barred with blackish, especially in summer. L. 23. W. 17. T. 10. Northern parts of Northern hemisphere; over the U. S. in winter; not rare. The handsomest of owls. (*Eu.*)

631. SURNIA Duméril (Mod. Gr., *σύρνιον*, name of an owl)

1033. **S. ulula caparoch** (Müller). American Hawk Owl. Day Owl. Brown, much mottled and barred; head with white spots; a dark collar about neck; lower parts barred, brown and white; tail barred. L. 16. W. 9. T. 7. Northern N. Am., S. to Neb. and R. I. (Lat., *ulula*, a screech owl; *caparoch*, from *caparacoch*, native name of this bird.)

632. SPEOTYTO Gloger (Gr., *σπέος*, cave; *τυτώ*, owl)

1034. **S. cunicularia hypugaea** (Bonaparte). Burrowing Owl. Brownish, much spotted, barred, and variegated with whitish. L. 10. W. 7½. T. 4. S. W. Canada to Panama, abundant W., accidental E. to Mass. (Lat., *cuniculārius*, a miner; Gr., *ὑπόγειος*, under ground.)

Order LII. PSITTACI (The Parrots)

" Frugivorous Raptores "; bill enormously thick, cered at base and strongly hooked; tongue thick and fleshy. Feet zygodactyle, by reversion of outer toe; tarsus reticulate. Tongue short, fleshy; upper jaw unusually movable.

Altricial. Plumage often brilliant. In all warm regions. Species nearly 600, nearly half of them American. (Gr., *ψίτταϰος*, a parrot.)

Families of Psittaci

a. Carotids two, the left superficial. . . . . PSITTACIDAE, CCVII.

FAMILY CCVII. PSITTACIDAE (THE PARROTS)

Parrots with 2 carotid arteries, the left superficial. This great group includes the majority of the parrots, — all of the American species.

a. Ambiens muscle present; a tufted oil gland; furculum complete. (*Arinae.*)
b. Face entirely feathered except a curve about the eye; tail graduated, the feathers narrowed. . . . . CONUROPSIS, 633.

633. CONUROPSIS Salvadori

(Gr., *ϰῶνος*, cone; *οὐρά*, tail; *ὄψις*, appearance [of *Conurus*, a Mexican genus])

1035. **C. carolinensis** (Linnaeus). CAROLINA PAROQUET. Green; head and neck yellow; face orange red; wings with blue and yellow; bill white; cere feathered. L. 13. W. 7½. T. 6. Southeastern U. S., formerly N. to New York; now exterminated, except possibly in Fla. (Lat., *carolinensis*, of Carolina.) A more bluish subspecies, **C. c. ludovicianus** (Linnaeus), inhabited the Mississippi Valley, north to the Great Lakes. (Lat., *ludovicianus*, of Louisiana.)

NOTE ON PICARIAE. Between the Parrots and the Singing Birds comes the series, or so-called order, of *Picariae*, a highly diversified group, including all the non-passerine land birds, except the pheasants, doves, and the birds with cered and hooked bill. In all, the hind toe is small (if present), and sometimes elevated; its claw is usually shorter than that of middle toe. The wing coverts are larger and in more numerous series than in the *Passeres*. The primaries are 10 in number, the first rarely short; tail usually of 10 feathers. Sternum non-passerine; musical apparatus imperfect; tarsus never presenting an undivided ridge behind. Nature altricial.

Recent writers usually subdivide the *Picariae* into three groups, which are recognized as distinct orders by the American Ornithologists' Union, under the name of *Coccyges*, *Pici*, and *Macrochires*. The last two are natural groups and well defined by anatomical characters. The *Coccyges*, however, are scarcely less varied than the *Picariae*, of which they form the greater part. Dr. Coues says: "I have no faith whatever in the integrity of any such grouping as *Picariae* implies, but if I should break up this conventional assemblage, I should not know what to do with the fragments." The so-called order *Acanthopteri* among fishes is a case somewhat parallel.

ORDER LIII. COCCYGES (THE CUCKOO-LIKE BIRDS)

This order includes the majority of the so-called "Picarian birds," some 15 families, not having very much in common, except that they lack the special peculiarities of the *Pici* and the *Macrochires*. The sternum is usually notched behind; the syringeal muscles are 2 pairs at most. Feet generally short, the toes variously arranged. Palate desmognathous. The group is "a mixed

lot requiring to be reconstructed by exclusion of some of the families entering into its composition." (*Coues.*) The kingfishers certainly have little in common with cuckoos or their singular Western relatives, the road runners (*Geococcyx*). (Gr., κόκκυξ, cuckoo.)

Families of Coccyges

a. Toes 2 in front, 2 behind; bill as long as head, compressed, the tomia entire; nostrils exposed; no rictal bristles; toes cleft at base. (Cuckoos.) . . Cuculidae, CCVIII.

aa. Toes 3 in front, 1 behind; bill straight, longer than head; feet syndactyle, the outer and middle toes grown together for half their length; tarsus very short. (Kingfishers.) Alcedinidae, CCIX.

Family CCVIII. **CUCULIDAE** (The Cuckoos)

Bill compressed, lengthened, without rictal bristles or nasal tufts. Tongue not extensible. Tarsus long, nearly naked; toes not webbed. Feet zygodactyle, by reversion of 4th toe. Species numerous, in various parts of the world. The American cuckoos build nests of their own, not laying eggs in nests of other birds as do the European species of *Cuculus*. (Lat., *cuculus*, cuckoo.)

a. Tail feathers 10; bill gently curved; plumage blended; arboreal. . . . Coccyzus, 634.

634. **COCCYZUS** Vieillot (Gr., κοκκύζω, I cry cuckoo!)

1036. **C. americanus** (Linnaeus). Yellow-billed Cuckoo. Rain Crow. Color lustrous drab; bill yellow below; wings with much cinnamon red; middle tail feathers like the back; outer ones black, with broad white tips. L. 12. W. 5½. T. 6. E. N. Am., N. to S. E. Canada, S. to Ecuador. (*Eu.*, accid.) (Lat., *americanus*, American.)

1037. **C. erythrophthalmus** (Wilson). Black-billed Cuckoo. Lustrous drab; bill chiefly black; wings with little or no reddish; tail feathers all brownish, obscurely whitish at tips. L. 11½. W. 5. T. 6¼. E. N. Am.; more common E.; N. to central S. and S. E. Canada, S. to Peru. (*Eu.*, accid.) (Gr., ἐρυθρός, red; ὀφθαλμός, eye.)

Family CCIX. **ALCEDINIDAE** (The Kingfishers)

Head large; bill long, straight and strong, usually longer than head; gape deep, tomia not serrate. Wings long; tail short. Legs quite small; feet syndactyle, — the outer and middle toes united half their length, with a continuous sole beneath; tibia naked below. Tail feathers 12. Species numerous, chiefly of the tropical parts of the Old World and Australia. Many of them feed upon fishes, and nearly all are remarkable for their brilliant metallic coloration. In many the bill is disproportionately large. (Lat., *alcedo*, kingfisher.)

a. Bill compressed, the culmen carinate; head crested; aquatic, feeding on fishes and crustaceans. . . . . Streptoceryle, 635.

635. STREPTOCERYLE Bonaparte

(Gr., *στρεπτός*, curved; *κηρύλος*, kingfisher)

1038. **S. alcyon** (Linnaeus). Belted Kingfisher. Ashy blue above, a bluish band across breast; white below; tail black, speckled and barred with white; ♀ with sides and band across belly chestnut. L. 13. W. 6. T. 3½. B. 2. E. N. Am., S. to British Guiana; common about streams, watching for fishes. (Gr., *ἀλκυών*, kingfisher.)

Order LIV. PICI (The Woodpeckers and Wrynecks)

A small order composed of the Woodpeckers, and two other closely related families. Feet zygodactyle, the outer toe permanently reversed, the hind toe wanting in one genus; metatarsus modified in connection with the reversed toe; wing with 10 primaries and short secondary coverts; tail with 10 quills, besides which, in the woodpeckers, is an outer pair of partly concealed spurious quills, making 12; bill straight, hard, and strong; palate saurognathous; sternum double-notched behind; salivary glands large. (Lat., *picus*, woodpecker.)

a. Nostrils covered by feathers; tail feathers rigid and acute. . . . . Picidae, CCX.

Family CCX. PICIDAE (The Woodpeckers)

Bill stout, usually straight, with the tip truncate or acute, fitted for hammering or boring into wood. Tongue long, flattish, barbed, capable of great protrusion, adapted for securing insects (except in *Sphyrapicus*); hyoid apparatus peculiar, its horns generally quite long, curving around the skull behind and over forward again to the ear or beyond. Feet zygodactyle, the hind toe sometimes wanting; claws compressed, sharp, and strong. Tail feathers 12, rigid and acuminate, the outer pair short, concealed; tail never forked; nasal tufts present.

Chiefly arboreal; all (except *Sphyrapicus*, which is truly a "Sapsucker") are pre-eminently insectivorous. For this reason these birds are of the greatest service to the farmer. Voice loud and harsh. Colors generally bright, the male at least having almost always red on the head; sexes usually slightly different. Species about 350, abundant almost everywhere.

a. Outer hind toe longer than outer anterior (middle) toe.
  b. Head with a conspicuous crest; (size very large; bill pale) . . Campephilus, 636.
  bb. Head not crested.
    c. Tongue pointed, highly extensible, as usual among woodpeckers; (no yellowish on belly).
      d. Hind toes 2; nasal groove running nearly to tip of bill, which is not much compressed toward tip. . . . . Dryobates, 637.
      dd. Hind toe single (the real hind toe wanting); bill broad, much compressed toward tip. . . . . Picoides, 638.
    cc. Tongue obtuse, brushy, scarcely extensible; nasal groove running into tomium near middle of bill; bill evidently compressed towards its tip; (belly more or less yellowish). . . . . Sphyrapicus, 640.

aa. Outer hind toe not longer than outer anterior toe.
e. Head conspicuously crested; (size large; bill dark). . . . . PHLOEOTOMUS, 639.
ee. Head not crested.
f. Upper mandible with a distinct low lateral ridge, the tip more or less truncate.
g. Back and wing coverts glossy black. . . . . MELANERPES, 641.
gg. Back and wings grayish, barred with black and white. . . . CENTURUS, 642.
ff. Upper mandible without distinct lateral ridge or nasal groove, the tip scarcely truncate. . . . . COLAPTES, 643.

636. CAMPEPHILUS Gray (Gr., *κάμπη*, caterpillar; *φίλος*, loving)

1039. **C. principalis** (Linnaeus). IVORY-BILLED WOODPECKER. Black with white on shoulders and wings; crest scarlet in ♂, black in ♀. L. 21. W. 11. T. 8. Southeastern U. S., formerly N. to S. Ind. (Lat., *principalis*, principal.)

637. DRYOBATES Boie (Gr., *δρῦς*, oak; *βάτης*, one who treads)

a. Back black, with a long white stripe; sides usually all white.

1040. **D. villosus** (Linnaeus). HAIRY WOODPECKER. BIG SAPSUCKER. Spotted and lengthwise streaked, but not banded; outer tail feathers wholly white. L. 9. W. 5. T. 3½. A scarlet nuchal band in ♂ only. N. E. U. S. and S. E. Canada, W. to E. Colo.; common. (Lat., *villosus*, hairy.) Runs into many subspecies, W. The southern race, **D. v. audubonii** (Swainson), is smaller. S. E. U. S., N. to S. E. Va. and S. Ill. (Lat., *audubonii*, to J. J. Audubon.)

1041. **D. pubescens** (Linnaeus). DOWNY WOODPECKER. LITTLE SAPSUCKER. Outer tail feathers white, barred with black; otherwise precisely like the other, but much smaller. L. 6½. W. 3¾. T. 2¾. S. E. U. S.; common. Runs into many variations. Subsp. **D. p. medianus** (Swainson) extends from Va. and Ill. north to S. E. Canada. (Lat., *pubescens*, becoming hairy or downy; *medianus*, median). Subsp. **D. p. microleucus** Oberholser occurs in Newfoundland.

aa. Back black, barred with white; sides usually spotted or streaked with black.

1042. **D. borealis** (Vieillot). RED-COCKADED WOODPECKER. Black and white, spotted below and crosswise banded above, but not streaked; a red line on each side of head in ♂. L. 8½. W. 4½. T. 3½. S. E. U. S., in woodlands, N. to N. J. (Lat., *borealis*, northern.)

638. PICOIDES Lacépède (Lat., *picus*, a woodpecker; Gr., *εἶδος*, appearance [of genus *Picus*])

1043. **P. arcticus** (Swainson). ARCTIC THREE-TOED WOODPECKER. BLACK-BACKED THREE-TOED WOODPECKER. Black and white; no white on back or top of head; crown yellow in ♂, plain in ♀. L. 9. W. 5. T. 3⅔. N. Am., S. in winter, to N. U. S., rarely to Nebr. and N. Fla. (Lat., *arcticus*, arctic.)

1044. P. **americanus** Brehm. American Three-toed Woodpecker. Back with white bars; usually more or less white on head; otherwise as in the preceding. L. 8. W. 4½. T. 3½. Arctic Am., except Alaska, S. in winter to Wisc. and Mass. (Lat., *americanus*, American.)

639. PHLOEOTOMUS[1] Cabanis & Heine (Gr., φλοιός, bark; τομός, cutting)
(*Hylatomus* Baird, not *Hylotoma*, a genus of insects)

1045. P. **pileatus** (Linnaeus). Pileated Woodpecker. Logcock. Cock of the Woods. Black; white streak down neck; crest and cheek patch scarlet in ♂; cheeks and front of crest black in ♀. L. 19. T. 7. S. E. U. S. except Fla.; in heavy timber. A shy bird, now rare. (Lat., *pileatus*, capped.) Subsp. P. p. **abieticola** Bangs, from Pa. northward. (Lat., *abieticola: abies*, fir tree; *incola*, an inhabitant.)

640. SPHYRAPICUS Baird (Gr., σφῦρα, hammer; Lat., *picus*, woodpecker)

1046. S. **varius** (Linnaeus). Yellow-bellied Sapsucker. Black and whitish above; black on breast; rump mixed black and white; belly yellowish; sides streaked with dusky; a white wing patch; quills with white spots; crown red in adult ♂, and usually ♀ also; chin scarlet, throat black in ♂; young brownish. L. 8¼. W. 4¾. T. 3⅓. East. and cent. N. Am., S. to Costa Rica. Not rare, feeds on inner bark, the only woodpecker that injures trees. (Lat., *varius*, different.)

641. MELANERPES Swainson (Gr., μέλας, black; ἕρπης, creeper)

1047. M. **erythrocephalus** (Linnaeus). Red-headed Woodpecker. Whole head and neck crimson in both sexes, bordered below by black; belly, rump, secondaries, etc., pure white; rest of body glossy blue-black. L. 9½. W. 5½. T. 3⅔. E. U. S. and S. E. Canada, rare in N. E., very abundant in the Middle West. (Gr., ἐρυθρός, red; κεφαλή, head.)

[1] The earlier name for the genus of Logcocks, *Hylatomus*, is set aside by the A. O. U. because of the still earlier *Hylotoma*, a genus of Insects. I have maintained, with Professor Baird, that "A name is a name without necessary meaning," and therefore that generic names are different unless spelled alike, even though derived from the same Greek roots. It seems to me better not to discard as preoccupied any generic name, unless it agrees absolutely in spelling, with some earlier name. The ornithologists and most palaeontologists, however, discard all names which, having the same meaning as some earlier one, differ only in gender, in the connective vowel, or in some other matter of minor importance. In the fishes, the usual rule has been to regard names as different, unless spelled alike. The matter has not reached a final decision before the International Commission of Nomenclature. It is hard to cover all cases by a hard and fast rule.

In the fishes I have preferred to use *Scaphirhynchus* rather than *Scaphirhynchops*, notwithstanding the earlier *Scaphorhynchus; Lagochila* rather than *Quassilabia*, notwithstanding *Lagocheilus; Thymallus* rather than *Choregon*, notwithstanding *Thymalus; Leucosomus* rather than *Chetlonemus*, notwithstanding *Leucosoma; Heterodontus* rather than *Centracion*, notwithstanding *Heterodon*, — all these being genera of fishes. In the Birds I follow the Ornithologists' Union. This involves suppression of *Hylatomus* for *Phlocotomus* because of the earlier *Hylotoma; Eremophila* for *Otocoris*, because of *Eremophilus; Parula* for *Compsothlypis*, because of *Parulus; Contopus* for *Nuttallornis*, because of *Contipus*.

642. CENTURUS Swainson (Gr., *κέντρον*, a point, a prickle; *οὐρά*, tail)

1048. **C. carolinus** (Linnaeus). Red-bellied Woodpecker. Grayish, much barred above with black and white; belly pale ashy, more or less reddish tinged; crown and nape crimson in ♂, crown gray in ♀. L. 9¾. W. 5. T. 3½. E. U. S., to Fla., more common S. and W. (Lat., *carolinus*, of Carolina.)

643. COLAPTES Vigors (Gr., *κολαπτής*, a chisel)

1049. **C. auratus** (Linnaeus). Flicker. Yellow-shafted Flicker. Yellow-hammer. Golden-winged Woodpecker. High-hole. Head ashy, with red nuchal crescent; back drab, barred with black; rump white; below anteriorly pinkish drab, shading into yellowish; a black crescent on breast; belly with numerous round black spots; shafts and under surfaces of quills golden yellow; a black maxillary patch. L. 12½. W. 6. T. 4½. E. U. S., N. to S. Ill., and S. Ind.; abundant. (Lat., *auratus*, golden.) The Northern Flicker, **C. a. luteus** Bangs, is larger. E. U. S., Va. and N. W. Tex. to S. E. Canada. (Lat., *luteus*, yellowish.) Subsp. **C. a. borealis** Ridgway, still larger, occupies northern N. A., S. to S. Dak. and Minn. (Lat., *borealis*, northern.)

1050. **C. cafer collaris** Vigors. Red-shafted Flicker. Quills with orange-red instead of golden; maxillary patches in ♂ red instead of black; no nuchal crescent; no yellowish on belly; the black spots fewer and smaller. L. 14. W. 6⅔. T. 5. Western N. A., from S. W. Canada to Northern Mex., E. to Iowa. It extensively forms hybrids with *C. auratus*. In Stanford University is a specimen from the Yosemite with the quills on one side red, on the other yellow. Baird and Coues note similar cases. (Lat., *cafer*, of Caffraria; *collaris*, pertaining to the neck.)

Order LV. MACROCHIRES

(The Goatsuckers, Swifts, and Humming Birds)

Fissirostral and tenuirostral Picariae. Wing very long and pointed, the fingers and primaries especially elongate. Feet small, weak, with 3 toes in front, 1 behind, the hind toe usually somewhat elevated; tail-feathers 10; palate aegithognathous, as in the Passeres. Three (of five) families, not closely related, are represented within our limits. (Gr., *μακρός*, long; *χείρ*, hand.)

a. Bill fissirostral, swallow-like; secondaries more than 6 (Goatsuckers).
b. Middle toe much longer than lateral toes, its claw pectinate; rictus with bristles; plumage very soft. . . . . Caprimulgidae, CCXI.
bb. Middle toe scarcely longer than lateral toes, its claw not pectinate; no rictal bristles; plumage compact. (Swifts.) . . . . . Micropodidae, CCXII.
aa. Bill tenuirostral, very long and slender; secondaries 6; plumage compact, partly with metallic luster. (Humming Birds.) . . . . . Trochilidae, CCXIII.

Family CCXI. CAPRIMULGIDAE (The Goatsuckers)

Bill very short, fissirostral, the gape exceedingly deep and wide, reaching to below the eyes, and usually with prominent rictal bristles. Wings long and pointed; secondaries lengthened. Plumage long and loose. Tail feathers 10. Feet very small; tarsus short; toes slightly webbed at base, the middle claw pectinate; hind toe somewhat elevated and lateral. Species numerous, widely diffused; chiefly insectivorous, largely nocturnal, and of noiseless flight, like owls. (Lat., *caprimulgus*, a goatsucker.)

a. Rictal bristles very long; tail rounded; tarsus largely feathered.
b. Rictal bristles with lateral branches. . . . . Antrostomus, 644.
bb. Rictal bristles simple. . . . . Setochalcis, 645.
aa. Rictal bristles inconspicuous; tail emarginate. . . . . Chordeiles, 646.

644. ANTROSTOMUS Bonaparte (Gr., *ἄντρον*, cave; *στόμα*, mouth)

1051. **A. carolinensis** (Gmelin). Chuck-will's-widow. More rubescent than *Setochalcis vocifera*. L. 12. T. 6½. Southeast. U. S., N. casually to Nova Scotia and S. E. Ont., S. to Colombia. (Lat., *carolinensis*, of Carolina.)

645. SETOCHALCIS Oberholser (Gr., *σής*, a moth; *χαλκίς*, a nocturnal bird)

1052. **S. vocifera** (Wilson). Whippoorwill. Nightjar. Grayish, very much variegated with blackish and buffy; pectoral bar and ends of outer tail feathers white (♂) or tawny (♀). L. 10. W. 6. T. 5. E. U. S., and S. E. Canada, S. to Costa Rica; common locally in damp woods. Nocturnal. Noted for its "solemn and prophetic cry," continually repeated in the night. (Lat., *vociferus*, noisy.)

646. CHORDEILES Swainson

(Gr., *χορδή*, a musical instrument; *δείλη*, evening)

1053. **C. minor** (Forster). Nighthawk. Bull-bat. Blackish, barred and mottled with grayish and buffy; a large wing spot, bar across tail, and V-shaped blotch on throat — white in ♂, tawny or obscure in ♀; the wing spot placed in front of tip of 7th quill. L. 9½. W. 8. T. 5. N. Am., S. to D. C., Tenn., and Va.; in winter to Argentina; abundant, flying high in evening or cloudy weather. (*Chordeiles virginianus* [Gmelin].) (Lat., *minor*, smaller.)

Family CCXII. MICROPODIDAE (The Swifts)

Bill fissirostral, as in the Goatsuckers and Swallows. Wings very long, thin, and pointed; secondaries very short. Feet small, weak; hind toe often elevated or otherwise turned; toes completely cleft; middle claw not pectinate; no rictal bristles; tail feathers 10; plumage compact. In most species the

salivary glands are highly developed, and their secretion is used as a glue in the construction of the nest; species of *Collocalia* in China thus form the edible bird's nests. Small birds of the warmer parts of the world, bearing a superficial resemblance to Swallows, but structurally very different, being closely related to the Humming Birds, nearer to them than to the Goatsuckers. Species numerous. (Gr., *μικρός*, small; *πούς*, foot.)

a. Tarsus bare, longer than middle toe; tail rounded, its feathers with the shafts spinous, projecting beyond the plumage . . . . . CHAETURA, 647.

647. CHAETURA Stephens (Gr., *χαίτη*, bristle; *οὐρά*, tail)

1054. **C. pelagica** (Linnaeus). CHIMNEY SWIFT. CHIMNEY SWALLOW. Sooty brown; throat paler. L. 5¼. W. 5. T. 2. Cent. and east. N. Am., S. to Guatemala; abundant. Now nesting in chimneys, formerly in hollow trees. (Lat., *pelagicus*, nomadic.)

FAMILY CCXIII. TROCHILIDAE (THE HUMMING BIRDS)

Bill subulate, usually longer than the head, straight or curved; tongue capable of great protrusion. Wings long and pointed, the secondaries short, only 6 in number; tail of 10 feathers. Feet very small, with long, sharp claws. Smallest of all birds and among the most brilliantly colored. Species 500 or more, one of the largest families in Ornithology. All are American, and most of them tropical, but our common Eastern species ranges far into Canada. Chiefly insectivorous; not musical. (Gr., *τροχίλος*, a kind of bird.)

a. First primary not attenuate, bowed or curved inwards; bill straight; frontal feathers covering nasal scales. . . . . ARCHILOCHUS, 648.

648. ARCHILOCHUS Reichenbach (Gr., *ἀρχός*, chief; *λόχος*, company)

1055. **A. colubris** (Linnaeus). RUBY-THROATED HUMMING BIRD. ♂ metallic green above; a ruby-red gorget; tail of ♂ moderately forked, uniformly dusty purplish; ♀ without red, the tail variegated; no scales on crown. L. 3¼. W. 1⅔. T. 1¼. B. ⅔. East. N. Am., N. to Sask.; S. to Panama. Abundant in summer, hovering about flowers. (Lat., *colubris*, from S. Am. name, *colibri*.)

ORDER LVI. PASSERES (THE PASSERINE BIRDS)

Toes 4; feet fitted for perching; the hind toe always on the level of the rest, its claw at least as long as that of the middle toe; joints of toes 2, 3, 4, 5, respectively, from 1st to 4th; none of the toes versatile, and none webbed; wing coverts few, chiefly in 2 series; tail feathers 12, rarely 10; primaries 10, but in most of the families the first one is reduced in size, and often rudimentary and displaced; musical apparatus more or less developed; sternum of a uniform passerine pattern; palate aegithognathous. Nature altricial.

This order includes about 6000 known species, or more than half of all the kinds of birds. They represent the "highest grade of development and the most complex organization of the class; their high physical irritability is coördinate with the rapidity of their respiration and circulation; they consume the most oxygen and live the fastest of all birds." (*Coues.*)

A considerable number of anatomical characters are more or less perfectly distinctive of the *Passeres*. These cannot, however, be discussed here. The group is divided, on anatomical characters, into about 3 suborders. Two of these groups, the *Clamatores* and the *Oscines*, are represented in our fauna. The latter, characterized especially by the perfect musical apparatus, comprises the vast majority of the *Passeres*. (Lat., *passer*, sparrow.)

Families of Passeres

a. *Tarsus with its hinder edge rounded*, encircled by a single horny envelope divided into scutella anteriorly and on outer side, this sometimes extending all round (though separated by a seam along inner side), but often widely separated on inner side or behind or both, the intervening space occupied by granular scales, reticulations, or plain naked skin; musical apparatus imperfect; primaries 10, the 1st about as long as 2d. (*Clamatores.*)

b. Inner toe free at base from middle toe; tarsus not reticulate behind; bill hooked at tip, with long rictal bristles. . . . . TYRANNIDAE, CCXIV.

aa. *Tarsus with its hinder edge compressed*, forming a sharp, nearly undivided ridge (except in the Larks, which may be known except from the wagtails by the long, nearly straight hind claw); musical apparatus highly developed; primaries properly 10, but the first short, or spurious, or sometimes rudimentary and misplaced, so that but 9 are evident, in which case the first developed primary is about as long as second. (*Oscines.*)

c. Hinder edge of tarsus not compressed, rounded and scutellate like anterior edge; hind claw very long, straightish; developed primaries 9. . . . . ALAUDIDAE, CCXV.

cc. Hinder edge of tarsus compressed, forming a sharp ridge, for the most part undivided.

d. Primaries apparently but 9 (the 1st minute and displaced); the 1st developed (i.e., 2d) primary about as long as the next; bill not hooked at tip.

e. Bill not fissirostral, the gape little longer than the culmen; outer primary never twice as long as inner.

f. Bill "conirostral," stout at base, with the commissure forming a more or less distinct angle at base of bill, "the corners of the mouth" drawn downward.

g. Bill rather long, often longer than head, without notch at tip or bristles at the rictus. . . . . ICTERIDAE, CCXVII.

gg. Bill shorter than head, often notched near tip, and usually with bristles at the rictus. . . . . FRINGILLIDAE, CCXVIII.

ff. Bill not truly conirostral (the corners of mouth not evidently drawn downward).

h. Bill stout (conical in our species, the cutting edge with one or more lobes or nicks near its middle); nostrils placed high, exposed; (plumage chiefly red or yellow, in our species). . . . . THRAUPIDAE, CCXIX.

hh. Bill rather slender, not conical; angle of gonys not before nostril.

i. Hind claw short and curved, mostly shorter than its toe; tertials not elongate, not nearly reaching tips of primaries. . . COMPSOTHLYPIDAE, CCXXIV.

ii. Hind claw long and straightish, mostly longer than its toe; tertials much elongate, nearly reaching tips of primaries. . . MOTACILLIDAE, CCXXV.

ee. Bill fissirostral, — the culmen very short, the gape very broad, its length more than twice the culmen; wings very acute, the outer primary more than twice length of innermost. . . . . HIRUNDINIDAE, CCXX.

dd. Primaries evidently 10, the first developed, but short, rarely half the length of the next; (first primary obsolete in some Vireos, known by the slightly hooked bill).

j. Tarsus distinctly scutellate.

k. Tarsus not longer than middle toe with claw; bill short, depressed; (head crested; tail tipped with yellow, in our species). . . . . BOMBYCILLIDAE, CCXXI.

kk. Tarsus longer than middle toe and claw (or if not, other characters not as above).
l. Bill strongly hooked and toothed at tip, somewhat like a hawk's bill; (plumage mostly gray). . . . . LANIIDAE, CCXXII.
ll. Bill slightly hooked at tip; (plumage more or less olivaceous). VIREONIDAE, CCXXIII.
lll. Bill not evidently hooked at tip.
m. Tail feathers stiff, pointed; bill decurved. . . CERTHIIDAE, CCXXVIII.
mm. Tail feathers more or less soft and rounded.
n. Nasal feathers directed forwards, usually covering the nostrils.
o. Birds of large size; (wing more than 4).. . . . CORVIDAE, CCXVI.
oo. Birds of small size; (wing less than 4).
p. Bill not notched.
q. Bill slender, as long as head. . . . . SITTIDAE, CCXXIX.
qq. Bill rather stout, shorter than head. . . PARIDAE, CCXXX.
pp. Bill notched toward the tip, very slender. MUSCICAPIDAE, CCXXXI.
nn. Nasal feathers erect or directed backward, not covering nostrils; bill rather slender, the culmen convex; first primary not very short.
g. Bill with no bristles at the rictus; inner toe joined to base of middle toe. (Wrens.) TROGLODYTIDAE, CCXXVII.
gg. Bill with bristles at the rictus; inner toe free to the base. (Mockers.) MIMIDAE, CCXXVI.
jj. Tarsus booted, without distinct scutella except near the base; rictal bristles present.
s. Birds of small size; (wing less than 3); young unspotted. SYLVIIDAE, CCXXXII.
ss. Birds of moderate size (wing more than 3); young spotted. TURDIDAE, CCXXXIII.

FAMILY CCXIV. TYRANNIDAE (THE FLYCATCHERS)

Primaries 10; the 1st more than $\frac{3}{4}$ length of 2d, longer than in any other of our passerine birds; bill typically broad, triangular, depressed, abruptly hooked and notched at tip, with long rictal bristles; commissure nearly straight; nostrils small, usually partly concealed. Tarsus with its back and sides as well as the front covered with scutella, so that there is no undivided ridge behind, as in most other *Passeres*. Feet small. Mouth capacious; vocal apparatus mesomyodian; i.e., the "syrinx with fewer than 4 distinct pairs of intrinsic muscles inserted at the middle of the upper bronchial half rings, constituting an uncomplicated and ineffective musical apparatus." (*Coues.*) Changes of plumage slight; ours mostly olivaceous.

A large family of more than 500 species; all American and mostly tropical. All are insectivorous, most of them preëminently so; they are, therefore, in our latitude, migratory.

a. Bill of typical form, depressed, hooked at tip, with strong rictal bristles.
b. Outer primaries, one or more of them, attenuate; crown in adult with a concealed red or yellow crest.
c. Tail deeply forked, much longer than wings. . . . . MUSCIVORA, 649.
cc. Tail not forked, not longer than wings. . . . . TYRANNUS, 650.
bb. Outer primaries not attenuate; crown without concealed bright-colored crest.
d. [Wings and tail with chestnut; length 8 or more]; head slightly crested; wings little longer than tail. . . . . MYIARCHUS, 651.
dd. [Wings and tail without chestnut; general color olivaceous; length less than 8.]
e. Wings at least 6 times as long as tarsus; (W. 3 to $4\frac{1}{4}$).
f. Tarsus shorter than middle toe with claw, wing about half longer than tail. NUTTALLORNIS, 653.

ff. Tarsus longer than middle toe with claw; wing not a 4th longer than tail. MYIOCHANES, 654.

ee. Wings not more than 5 times as long as tarsus, little longer than tail.

g. Bill rather narrow (black in our species; wing more than 3¼). . SAYORNIS, 652.

gg. Bill broad (usually pale below in our species; wing less than 3¼). EMPIDONAX, 655.

649. MUSCIVORA Lacépède (Lat., *musca*, fly; *voro*, I devour)

1056. **M. tyrannus** (Linnaeus). FORK-TAILED FLYCATCHER. No red or pink; tail black, extremely long. L. 13½. W. 4½. T. 9½. Patagonia to S. Mex., straying N. to Me. and Ky. (Lat., *tyrannus*, a ruler.)

1057. **M. forficata** (Gmelin). SCISSOR-TAILED FLYCATCHER. Ashy; tail chiefly white; crissum, shoulders, sides, etc., with much red and pink. L. 13. W. 5. T. 8. Central- south U. S., South to Panama, N. to Mo., straying E. to Fla. and Quebec. A bird of striking appearance. (Lat., *forficatus*, forked, from *forfex*, shears.)

650. TYRANNUS Lacépède (Lat., *tyrannus*, a ruler)

1058. **T. tyrannus** (Linnaeus). KINGBIRD. BEE MARTIN. Blackish, white below; crown patch orange; tail black, white-tipped. L. 8¼. W. 4⅜. T. 3½. N. Am., chiefly E.; N. to Mackenzie, S. to Bolivia; very abundant. "Destroys a thousand noxious insects for every bee it eats!" (*Coues.*)

1059. **T. verticalis** Say. ARKANSAS KINGBIRD. Ashy gray; yellow below; tail black, white-edged. L. 9. W. 5. T. 3¾. W. N. Am., N. to B. C., S. to Guatemala, straying E. to Me. and Fla. (Lat., *verticalis*, pertaining to the *vertex*, top of head, which is ornate.)

651. MYIARCHUS Cabanis (Gr., μυῖα, fly; ἀρχός, ruler)

1060. **M. crinitus** (Linnaeus). CRESTED FLYCATCHER. Scarcely crested; olivaceous, with bright chestnut on wings and tail; breast ashy gray; belly clear yellow. L. 8¾. W. 4. T. 4. E. U. S., chiefly S., N. to S. Manitoba and S. Quebec; S. to Colombia. A handsome bird, "noted for the habitual use of cast-off snake skins in the structure of its nest." (Lat., *crinitus*, long-haired; i.e., crested.)

652. SAYORNIS Gray (To Thomas Say + Gr., ὄρνις, bird)

1061. **S. phoebe** (Latham.) PHOEBE. PEWEE. Olive brown, head and tail darker; whitish or yellowish below. L. 7. W. 3½. T. 3¼. E. U. S., N. to Manitoba and N. B., S. to Colombia; common. Known by its black bill. (From Phoebe, the name of the bird in English.)

1062. **S. sayus** (Bonaparte). SAY'S PHOEBE. Ashy brown, the belly pale cinnamon, the tail black. L. 8. W. 4. T. 3¾. W. N. Am., E. to Iowa, casually to Mass. (To Thomas Say, an early zoölogist.)

653. NUTTALLORNIS Ridgway (*Contopus* Cabanis)
(To Thomas Nuttall + Gr., ὄρνις, bird)

1063. **N. borealis** (Swainson). Olive-sided Flycatcher. Rictal bristles short, ¼ length of bill; slaty brown above, with darker streaks; quills blackish; tarsus shorter than middle toe with claw, wing about half longer than tail; a white cottony patch on each side of rump; middle line of belly distinctly and abruptly white, otherwise brownish below. L. 7½. W. 4⅓. T. 3. N. N. Am., S. to N. C., in winter to Peru; in mountains and pine forests. (Lat., *borealis*, northern.)

654. MYIOCHANES Cabanis & Heine (Gr., μυῖα, fly; χαίνω, I gulp down)

1064. **M. virens** (Linnaeus). Wood Pewee. Rictal bristles half length of bill; wing bands whitish or yellowish; olive brown above; pale or yellowish below; lower mandible usually pale. L. 6¼. W. 3¼. T. 2¾. B. ½. U. S., N. to S. E. Canada, S. to Peru; abundant. Known from the Phoebe by its drawling notes. (Lat., *virens*, becoming green.)

1065. **M. richardsonii** (Swainson). Darker and less olivaceous, more gray below. L. 6½. W. 3⅓. T. 2¾. W. N. Am., E. to Wisc., S. to Bolivia; nearly like the preceding, but the notes and nesting different. (To John Richardson.)

655. EMPIDONAX Cabanis (Gr., ἐμπίς, gnat; ἄναξ, king)

a. Lower parts distinctly yellow.

1066. **E. flaviventris** (W. M. Baird and S. F. Baird). Yellow-bellied Flycatcher. Clear olive green; yellow below, becoming bright yellow (not merely slightly yellowish as in the others) on the belly; 1st primary about equal to 6th; bill yellow below. L. 5¼. W. 2¾. T. 2½. B. ½. Ts. ⅔. E. N. Am., S. to Panama. (Lat., *flavus*, yellow; *venter*, belly.)

aa. Lower parts not distinctly yellow.

1067. **E. virescens** (Vieillot). Acadian Flycatcher. Clear olive green, wing bands buffy; whitish or slightly yellowish below; yellowish ring about eyes; bill pale below; primaries nearly an inch longer than secondaries; 2d, 3d, and 4th primaries nearly equal, and much longer than 1st and 5th; 1st much longer than 6th. L. 6. W. 3. T. 2¾. Ts. ⅔. B. ⅔. E. U. S., and S. E. Canada, S. to Ecuador. (Lat., *virescens*, greenish.)

1068. **E. traillii** (Audubon). Traill's Flycatcher. Brownish olive, duller than *E. virescens;* bill pale below; 5th primary about as long as 4th, 1st not much longer than 6th; middle toe ⅔ length of tarsus; longest primary ⅔ inch longer than secondaries. L. 5¾. W. 2¾. T. 2½. B. ⅜. Ts. ⅔. (To T. S. Traill.) N. E. and cent. N. Am., S. to Ecuador. (*E. t. alnorum* Brewster.)

1069. **E. minimus** (W. M. Baird and S. F. Baird). Least Flycatcher. Chebec. Olive gray; bill blackish below; wings like preceding, but longest primary only ½ inch longer than secondaries; middle toe half as long as tarsus; tail slightly emarginate. L. 5. W. 2½. T. 2¼. B. ½. Ts. ⅔. Cent. and E. N. Am., S. to Peru; abundant. Very similar to *E. traillii*, known most readily by the measurements. (Lat., *minimus*, least.)

Family CCXV. ALAUDIDAE (The Larks)

First primary very short or obsolete. Tarsus obtuse and scutellate behind as well as in front (a character singular among *Oscines*). Bill short, varied in different species; nostrils concealed by tufts of antrorse feathers; hind claw very long and nearly straight; inner secondaries lengthened and flowing. About 150 species, chiefly Old World birds, a single genus in America; some of them are renowned as vocalists. Preëminent is the Skylark, *Alauda arvensis* L., a species introduced into America (Long Island, etc.). (Lat., *alauda*, lark.)

a. Spurious primary obsolete; a little tuft of lengthened black feathers over each ear (sometimes obscure in ♀); tail not forked. . . . . Otocoris, 656.

656. OTOCORIS Bonaparte (*Eremophila* Boie)
(Gr., οὖς, ear; κόρυς, helmet)

1070. **O. alpestris** (Linnaeus). Shore Lark. Horned Lark. Pinkish brown, thickly streaked; a crescent on breast and stripe under eye black; white below; chin, throat, and line over eye more or less yellow; ♀ with less black; winter birds grayish, with the markings more obscure. L. 7¼. W. 4¼. T. 3. N. E. N. Am., S. in winter to S. C.; common. A pleasant singer. (Lat., *alpestris*, of the Alps.) Runs westward into many variants, the prairie form (**O. a. praticola** Henshaw), averaging smaller, W. 4 to 4⅓, etc., occupies E. U. S. and S. E. Canada. (Lat., *praticola: pratum*, meadow; *incola*, inhabitant.) **O. a. hoyti** Bishop ranges from central Canada, S. to north-central U. S. (To W. H. Hoyt.)

Family CCXVI. CORVIDAE[1] (The Crows and Jays)

Primaries 10; the 1st about half length of 2d; nostrils usually concealed by tufts of bristly feathers. Bill long and strong, usually notched, its commissure not angulated. Tarsus sharp behind, its sides undivided and separated

[1] Near here should be mentioned the introduced and now naturalized :

Family **Sturnidae** (Starlings)

Sturnus Linnaeus (Lat., *sturnus*, a starling)

Sturnus vulgaris L. European Starling. Purplish and greenish; black, glossy, speckled with buffy or whitish. Bill whitish. Young brown. L. 8. W. 5. T. 2¾. B. 1. Europe; accidental in Greenland; introduced and now common in E. U. S. and S. E. Canada. (Lat., *vulgaris*, common.)

from the scutella in front by a groove, which is either naked or filled in with small scales. Voice usually harsh and unmusical, the temperament unsocial.

Birds of large size, largest of the *Oscines;* species numerous; found almost everywhere.

a. Tail not shorter than the short, rounded wing. (*Garrulinae.*)
b. Tail much longer than wing, graduated for half its length, its feathers narrowed to the tips; head not crested. (Magpies.) . . . . . PICA, 657.
bb. Tail not much longer than wings, not graduated for half its length.
c. Head with a conspicuous crest; (plumage often chiefly blue). (Jays.) CYANOCITTA, 658.
dd. Head without crest; plumage lax; (no bluish). . . . . PERISOREUS, 659.
aa. Tail much shorter than the long, pointed wings. (*Corvinae.*)
d. Bill compressed, higher than broad; plumage glossy. . . . . CORVUS, 660.

657. PICA Brisson (Lat., *pica,* magpie)

1071. **P. pica hudsonia** (Sabine) AMERICAN MAGPIE. Lustrous black; belly, shoulders, and wing-edgings white. L. 19. W. 8½. T. 13. Northern regions. Its range is chiefly northwest. N. Am., S. to Tex., straggling E. to Quebec. (Lat., *hudsonia,* of Hudson [Bay].)

658. CYANOCITTA Strickland (Gr., κύανος, blue; κίττα, jay)

1072. **C. cristata** (Linnaeus). BLUE JAY. Blue; collar and frontlet black; grayish below; wings and tail clear blue, barred; outer tail feathers and secondaries tipped with white. L. 12. W. 5½. T. 5¾. S. E. U. S., north to S. Ill., very abundant. (Lat., *cristatus,* crested.) The NORTHERN BLUE JAY, **C. c. bromia** Oberholser, is larger, with more white on wings and tail. Northeast. U. S. and S. E. Canada. (Gr., βρόμιος, noisy.)

659. PERISOREUS Bonaparte (Gr., περισωρεύω, heap up)

1073. **P. canadensis** (Linnaeus). CANADA JAY. GRAY JAY. WHISKEY JACK. CAMP ROBBER. Ashy gray, with blackish and whitish markings. L. 10¾. W. 5¾. T. 6. N. N. Am., S. in winter to Neb. and Pa. (Lat., *canadensis,* of Canada.)

660. CORVUS Linnaeus (Lat., *corvus,* crow)

a. Plumage entirely lustrous black.

1074. **C. corax europhilus** Oberholser. AMERICAN RAVEN. Feathers of throat stiffened, elongated, narrow, and lanceolate, their outlines very distinct. L. 25. W. 17. T. 10. E. U. S. and S. E. Canada; rare E. of Miss. R., in U. S. (*corax,* Gr., κόραξ, raven; *europhilus:* εὖρος, the southeast wind; φιλέω, I love.)

1075. **C. brachyrhynchos** Brehm. AMERICAN CROW. Feathers of throat short, broad, obtuse, with their webs blended; gloss of plumage purplish violet; head and neck scarcely lustrous. L. 20. W. 13. T. 8. Ts. 2⅛. B. 2.

Northeast. U. S. and E. Canada; abundant. (Gr., *βραχύs*, short; *ῥύγχοs*, bill.) Subsp. **C. b. paulus** Howell, is smaller. Southeast. U. S., N. to Maryland. (Lat., *paulus*, little.)

1076. C. **ossifragus** Wilson. Fish Crow. Gloss of plumage green and violet, evident on head and neck; feathers of throat short, blended. L. 16. W. 11. T. 7. B. 1⅔. Ts. 1¾. Conn. to S. E. Tex., mostly along the coast. (Lat., *ossifragus*, bone-breaking.)

Family CCXVII. ICTERIDAE (The American "Orioles" and "Blackbirds")

Primaries 9; bill with the commissure angulated, as in *Fringillidae*, but usually lengthened, rarely shorter than head, straight or gently curved, without notch or rictal bristles; culmen usually extending up on the forehead, dividing the frontal feathers. Legs stout, adapted for walking. Plumage usually brilliant or lustrous, the predominant color generally black, often with red or yellow; females usually different, smaller in size, brown or streaky in the lustrous species, and yellowish or dusky in the bright colored ones. Notes usually sharp, often richly melodious, but in some cases harsh. Excepting the Orioles, the species feed chiefly on seeds.

Species numerous, all American, some of the short-billed forms forming an almost perfect transition to the *Fringillidae;* others are apparently as closely related to the *Sturnidae* (starlings), which in turn are allied to the *Corvidae.*

a. Outlines of bill nearly or quite straight, the tip not evidently decurved; the commissure not sinuated. (*Icterinae.*)
  b. Bill stout, conical; its depth at base at least ½ its length; sexes unlike; ♀ smaller.
    c. Tail feathers acute; middle toe with claw longer than tarsus; bill shorter than head, finch-like. . . . . Dolichonyx, 661.
    cc. Tail feathers not acute; middle toe with claw not longer than tarsus.
      d. Bill much shorter than head, finch-like. . . . . Molothrus, 662.
      dd. Bill about as long as head.
        e. Lateral claws elongate, reaching beyond base of middle claw. Xanthocephalus, 663.
        ee. Lateral claws shortish, scarcely reaching base of middle claw. . Agelaius, 664.
  bb. Bill slender, its depth at base scarcely ½ its length.
    f. Tail not ⅔ length of wing, its feathers acute; tertials lengthened; bill longer than head; feathers of crown each tipped by the bristle-like shaft; sexes similar. Sturnella, 665.
    ff. Tail nearly as long as wing, its feathers not pointed; bill shorter than head; feathers of crown not bristle-tipped; sexes unlike in color. . . . . Icterus, 666.
aa. Outlines of bill distinctly curved, the tip decurved; the commissure evidently sinuated. (*Quiscalinae.*)
  g. Tail much shorter than wing, nearly even; bill slender, shorter than head. Euphagus, 667.
  gg. Tail longer than wing, graduated, the middle feathers lowermost when the tail is folded; bill stout, not shorter than head.
    h. Sexes similar; L. less than 15 inches. . . . . Quiscalus, 668.
    hh. Sexes unlike. ♀ smaller, with much shorter tail and less iridescence. L. not less than 15 inches. . . . . Megaquiscalus, 669.

661. DOLICHONYX Swainson (Gr., δολιχός, long; ὄνυξ, claw)

1077. **D. oryzivorus** (Linnaeus). Bobolink. Reed Bird. Rice Bird. ♂ in spring black, neck buffy, shoulders and rump ashy white, back streaky; ♀, and fall ♂, yellowish brown, streaked above, dull yellowish birds, resembling sparrows, but known by the acute tail feathers. L. 7½. W. 4. T. 3. Temperate N. Am., S. to Paraguay, abundant in meadows northward, when, in the breeding season, it is our merriest and most delightful songster. Retiring southward in the fall, it fattens in the rice swamps and was formerly slaughtered by the thousands for city markets. (Lat., *oryza*, rice; *voro*, I devour.)

662. MOLOTHRUS Swainson (Gr., μολοθρός, vagabond)

1078. **M. ater** (Boddaert). Cowbird. ♂ iridescent black, head and neck glossy brown; ♀ much smaller, dusky brown. L. (♂) 8. W. 4. T. 3. E. N. Am., S. to cent. Mex., abundant; noted for its parasitic habits. It builds no nests, but lays its eggs in the nests of warblers, vireos, and other small birds. (Lat., *ater*, black.) Subsp. **M. a. artemisiae** Grinnell, is larger. W. N. Am., E. to N. Dak. and Manitoba. (Lat., *artemisia*, sagebrush.)

663. XANTHOCEPHALUS Bonaparte (Gr., ξανθός, yellow; κεφαλή, head)

1079. **X. xanthocephalus** (Bonaparte). Yellow-headed Blackbird. ♂ black with white wing patch; head and neck deep yellow; ♀ smaller, browner, with less yellow. L. 10. W. 5½. T. 4½. W. N. Am., E. to Ind., casually Me., S. to south-cent. Mex., etc., in swamps. A large and showy bird.

664. AGELAIUS Vieillot (Gr., ἀγελαῖος, gregarious)

1080. **A. phoeniceus predatorius** (Wilson). Red-winged Blackbird. Swamp Blackbird. ♂ glossy (not iridescent) black, lesser wing coverts scarlet, with buffy and paler edging; ♀ and young dusky, streaked; with rusty on bend of wing. L. 9. W. 5. T. 4. E. U. S., and S. E. Canada; everywhere abundant. (Gr., φοινίκεος, tyrian red; Lat., *predatorius*, predatory.) Replaced in the central-northern region E. to Mich. by the Giant Redwing, **A. p. arctolegus** Oberholser. (*arctolegus:* Gr., ἄρκτος, north; λέγω, I choose.)

665. STURNELLA Vieillot (Lat., diminutive of *sturnus*, starling)

1081. **S. magna** (Linnaeus) Meadowlark. Brownish and much streaked above; chiefly yellow below, a black crescent on breast; yellow of throat not encroaching on cheeks; sides and crissum buffy. L. 10. W. 5. T. 3½. E. N. Am. (except Southern states in summer); very abundant. (Lat., *magnus*, large, as compared with the skylark [*Alauda*] to which this bird is not related.)

The smaller **S. m. argutula** Bangs occupies Southeast. U. S., N. to S. Ill. and S. Ind. (Lat., *argutulus*, a little talkative.)

1082. **S. neglecta** (Audubon). Western Meadowlark. Very similar, the colors duller and paler, the yellow of throat encroaching on sides of lower jaw; sides and crissum nearly white, bars on wings and tail less confluent. W. N. Am., E. to Ill., S. to cent. Mex. Almost exactly like *S. magna*, but the song quite different, thrush-like; it is now regarded as a distinct species. (Lat., *neglectus*, neglected.)

666. ICTERUS Brisson (Gr., ἴκτερος, yellow)

a. Depth of bill at base not half its length above. (*Pendulinus* Vieillot.)

1083. **I. spurius** (Linnaeus). Orchard Oriole. ♂ black; rump, bend of wing, and lower parts deep chestnut; ♀ yellowish olive, small; young yellowish, with various black or chestnut traces; young ♂ yellowish, with black throat patch. L. 7. W. 3½. T. 3. E. U. S. and S. E. Canada, common southerly, S. to Colombia. A fine singer and an artist in nest building. (Lat., *spurius*, spurious.)

aa. Depth of bill at base half its length. (*Yphantes* Vieillot.)

1084. **I. galbula** (Linnaeus). Baltimore Oriole. Golden Robin. Firebird. Black; bend of wing, rump, most tail feathers, and under parts from the breast, orange of varying intensity; ♀ duller, olivaceous and yellow. L. 7¾. W. 3⅔. T. 3. Temperate E. N. Am., S. to Colombia; common. Noted for its elaborate hanging nest as well as for its delightful song. (Lat., *galbula*, ancient name of some bird.)

1085. **I. bullockii** (Swainson). Similar, but a little larger, the orange extending farther on head, neck, and forehead, leaving a narrow space at the throat; lores black; a large white patch on wing. L. 8. W. 4. T. 3½. W. N. Am., E. to Kans. (accidental to Me.), S. to S. Mexico. (To Wm. Bullock.)

667. EUPHAGUS Cassin (Gr., εὖ, well; φάγος, eater)

1086. **E. carolinus** (Müller). Rusty Blackbird. Rusty Grackle. ♂ glossy black, becoming rusty in autumn; ♀ dusky, lusterless. L. 9½. W. 4¾. T. 4. N. and E. N. Am., S. to Fla. and Lower Cal. (Lat., *carolinus*. of Carolina.)

1087. **E. cyanocephalus** (Wagler). Brewer's Blackbird. ♂ black with green luster; head glossed with violet; ♀ dusky brown. L. 10. W. 5⅓. T. 4½. W. N. A., straying E. to Ill., abundant in Cal. (Gr., κύανος, blue; κεφαλή, head.)

668. QUISCALUS Vieillot (Lat., *quiscula*, a quail)

1088. **Q. quiscula ridgwayi** Oberholser. Crow Blackbird. Purple Grackle. Iridescent black, luster on head and body bluish, purplish, or greenish. L. 13. W. 5½. T. 5⅓. E. U. S., and S. E. Canada, abundant; found chiefly S. of N. Y. and E. of Alleghenies. (Lat., *quiscula*, a quail; *ridgwayi*, to Robert Ridgway.) The Bronzed Grackle, **Q. q. aeneus** Ridgway, is the common form N. to Canada and W. to Rocky Mts., and has the body of uniform bronze luster, without mixed tints, this color abruptly defined against the iridescent violet of the neck. (Lat., *aeneus*, brassy.)

669. MEGAQUISCALUS Cassin (Gr., *μέγας*, large + *Quiscalus*)

1089. **M. major** (Vieillot). Boat-tailed Grackle. Iridescent green and blue. Larger. L. 17. W. 7½. T. 7½. Va. to Texas and S. to Mexico; not common. (Lat., *major*, larger.)

Family CCXVIII. FRINGILLIDAE[1] (The Finches)

Primaries 9, the first being obsolete. Bill "conirostral," mostly shorter than head, robust, of a conical form, with the commissure more or less abruptly angulated near its base; in other words, the "corners of the mouth drawn down." This feature is usually strongly marked, and it is almost the only distinctive character pertaining to all the members of the family. Even this is also shared by the *Icteridae*, which, however, may generally be distinguished by the greater length and slenderness of the bill. Nostrils high up, exposed or (in northern species) partly covered by a ruff of small feathers. Tarsus scutellate in front, with an undivided ridge behind.

A very large family, the most extensive in Ornithology, comprising about 150 genera and 1000 species, found in nearly every part of the world, except Australia. They are especially abundant in North America, where about ⅛th of all the birds are *Fringillidae*. "Any one United States locality of average attractiveness to birds, has a bird fauna of over 200 species, and if it be away

[1] Sundevall and Stejneger have placed the *Fringillidae* at the head of the series of birds, for reasons which seem to me valid. "In order to find out the most specialized form of the *Passeres*, we must look for the bird which is most specialized in all directions, not only as to the coloration of its plumage, or the fusion of its tarsal covering. The ideally highest form . . . would have booted tarsi, 9 primaries, long mandibular symphysis, powerful bill for grain crushing, a digestive system adapted for grain feeding, and the coloration of young and adult unspotted and similar. That this is the regular course and ultimate end of the evolution among the higher birds is evident from the fact that we can trace it in nearly all the groups, and in the individual development of the birds possessing these characters." (*Stejneger.*)

Acting on this principle, Stejneger selects as the highest or most specialized bird the Evening Grosbeak (*Hesperiphona*). "The number of its primaries is reduced to 9, the mandibular symphysis is well developed, the palatine and facial part of the skull is highly specialized, and so is the digestive canal. Furthermore, the plumage of the young is essentially like that of the adults." It fails, then, in only one respect, — its tarsus is not booted.

In most recent American systems, however, the *Turdidae*, with booted tarsus, are placed at the head of the list; and as the A. O. U. has adopted this arrangement, it is retained here, the "post of honor" being given to the beautiful Arctic Bluebird rather than to the Evening Grosbeak, although the latter may have the better claim. The Bluebird is also farther removed from the "Crow" and other less specialized *Oscines*.

from the seacoast, and consequently uninhabited by marine birds, about ¼th of the species are *Compsothlypidae* and *Fringillidae* together, the latter somewhat in excess of the former. It is not easy, therefore, to give undue prominence to these two families." (*Coues.*)

All the Finches are granivorous, feeding chiefly on seeds, but not rejecting either berries or insects; nearly all sing, and some most delightfully; most of them are plainly clad, a streaky brown being the prevailing tint, but others are among the most brilliantly colored birds. Among these latter only are the changes in plumage strongly marked. (Lat., *fringilla*, finch.)

A strictly natural analysis of the genera of *Fringillidae* is practically impossible, as they do not fall naturally into definable groups. The characters drawn from the development of the palate are not available for the ordinary purposes of the student.

a. Mandibles falcate, crossed at tip; nostrils concealed by a small ruff. . . . LOXIA, 673.
aa. Mandibles not crossed at tip.
b. Head with a conspicuous crest; bill very large; culmen strongly curved (bill, wings, and tail chiefly red). . . . . RICHMONDENA, 697.
bb. Head without crest.
c. Bill very stout, its depth at base equal to length of hind toe with claw, and more than ¾ tarsus; nostrils partly concealed. . . . . HESPERIPHONA, 670.
cc. Bill less stout, its depth at base less than length of hind toe with claw.
e. Nasal plumules long, covering the basal third of upper mandible; bill stout. PINICOLA, 671.
ee. Nasal plumules, if present, covering much less than ½ of length of upper mandible.
f. Gonys distinctly convex in profile; (plumage streaked above, not below; no white, red, yellow, or blue). Introduced birds. . . . . (*Passer*) p. 333.
ff. Gonys straight or nearly so. Native birds.
g. Primaries much longer than secondaries (exceeding them by length of tarsus).
h. Wing at least 5 times as long as the short tarsus.
i. Birds of moderate size, the wing more than 3½ inches.
j. Base of gonys nearer base of bill than its tip (measuring along side of bill); (tail feathers without white; tail coverts rosy); hind claw moderate. LEUCOSTICTE, 674.
jj. Base of gonys as near tip of lower mandible as to its base on the side; (tail largely white; plumage with much white and no rosy); hind claw very long, nearly as long as bill. . . . . PLECTROPHENAX, 678.
ii. Birds of small size, the wing less than 3½; tail forked.
k. Nasal tufts very long, nearly ½ length of bill; (tail feathers without white or yellow; adults with red). . . . . ACANTHIS, 675.
kk. Nasal tufts short or obsolete, not ½ length of bill; (tail feathers blotched with white or yellow; adults with yellow but no red).
l. Bill not very sharp; no ruff at base; sexes unlike. ASTRAGALINUS, 676.
ll. Bill very sharp; a small ruff at base; sexes similar. . SPINUS, 677.
hh. Wing not 5 times as long as tarsus.
m. First (developed) primary not shorter than 4th; (back streaked).
n. Depth of bill at base about equal to length of (exposed) culmen; nostrils with a small ruff; (plumage streaked above and below; ♂ with red; no white on tail). . . . . CARPODACUS, 672.
nn. Depth of bill at base less than length of (exposed) culmen; (no red; tail with white).
o. Tail emarginate, the middle feathers narrow and pointed at tip; hind claw very long and straightish, nearly as long as bill.
p. Gonys shorter than hind toe without claw and not more than depth of bill. . . . . CALCARIUS, 679.

pp. Gonys longer than hind toe and greater than depth of bill. RHYNCOPHANES, 680.

oo. Tail rounded; the middle feathers broad and rounded at tip; hind toe short, curved. . . . . CHONDESTES, 689.

mm. First (developed) primary shorter than 4th; bill very stout; (plumage with red or yellow). . . . . HEDYMELES, 698.

gg. Primaries not much longer than secondaries (exceeding them by less than length of tarsus); (no red).

q. Bill very stout; its depth at base nearly equal to hind toe with claw; (♂ with blue). . . . . GUIRACA, 699.

qq. Bill more slender, not as above.

r. Tail feathers narrow, at least the middle ones acuminate; (back streaked).

s. Middle toe with claw decidedly shorter than tarsus; (outer tail feathers with white; bend of wing chestnut). . . . . POOECETES, 681.

ss. Middle toe with claw not shorter than tarsus; (outer tail feathers without white markings; edge of wing yellow).

t. (Breast with yellow; throat with more or less black; plumage not streaked below in ♂). . . . . SPIZA, 701.

tt. (Breast without yellow; throat without black; plumage streaked below.)

u. Outer pair of tail feathers longer than middle pair; wing much longer than tail. . . . . PASSERCULUS, 682.

uu. Outer pair of tail feathers shorter than middle pair; tail feathers acute; wing little if any longer than tail.

v. Tail double-rounded, the lateral quills not much shorter than middle ones. . . . . AMMODRAMUS, 684.

vv. Tail graduated, the outer quills much shorter than middle ones.

w. Outermost primary longest or equal to longest. CENTRONYX, 683.

ww. Outermost primary shorter than longest.

x. First (outermost) primary shorter than seventh. THRYOSPIZA, 688.

xx. First primary longer than seventh.

y. First primary longer than fifth. PASSERHERBULUS, 686.

yy. First primary not longer than fifth.

z. Exposed culmen much less than twice height of bill at base. . . . . NEMOSPIZA, 685.

zz. Exposed culmen about twice height of bill at base. AMMOSPIZA, 687.

rr. Tail feathers broader, not acuminate (except in worn plumage).

a2. Hind claw decidedly longer than its toe.

b2. Bill tapering rapidly to the acute tip; nostrils concealed by small antrorse feathers; (plumage streaked above and below). . . . . PASSERELLA, 695.

bb2. Bill tapering gradually toward the rather obtuse tip; nostrils exposed; (plumage not streaked). . . . . PIPILO, 696.

aa2. Hind claw scarcely longer than its toe.

c2. Tertials very long, much longer than secondaries, not much shorter than longest primaries; (a white wing patch). . . . . CALAMOSPIZA, 702.

cc2. Tertials scarcely or not longer than secondaries, not nearly reaching tips of longest primaries.

d2. (Outer tail feather largely white; plumage not streaked). . . . . JUNCO, 692.

dd2. (Outer tail feather not white.)

e2. Lower mandible much deeper than upper; (♂ with blue or green). PASSERINA, 700.

ee2. Lower mandible not deeper than upper; (plumage streaky above; no blue); wings not much longer than tail.

f2. Tail more or less forked; its middle feathers shortest; (no yellow; plumage not streaked below except in young). . . . . SPIZELLA, 691.

ff2. Tail rounded (or slightly double-rounded).

g2. Primaries exceeding secondaries by more than length of bill; (head in adult striped; in young chestnut; plumage not much, if any, streaked below). ZONOTRICHIA, 690.

gg2. Primaries exceeding secondaries by not more than length of bill.
h2. Edge of wing yellow; plumage not streaked below. . . PEUCAEA, 693.
hh2. No yellow anywhere; plumage streaked below, or else with the crown chestnut. . . . . MELOSPIZA, 694.

670. HESPERIPHONA Bonaparte (Gr., *ἑσπέρα*, evening; *φωνή*, voice)

1090. **H. vespertina** (Cooper). EVENING GROSBEAK. Olivaceous; crown, wings, tail, and tibia black; forehead, rump, and crissum yellow; inner secondaries and coverts white; bill very large, yellowish; ♀ grayer, with little yellow. L. 8. W. 4¼. T. 2¾. Central N. Am., irregularly S. to Mo. and Maryland and E. to New England. One of the most striking of the finches. (Lat., *vespertinus*, pertaining to the evening.)

671. PINICOLA Vieillot (Lat., *pinus*, pine; *incola*, an inhabitant)

1091. **P. enucleator leucura** (Müller). PINE GROSBEAK. ♂ chiefly rose red; changing to ashy behind; wings dusky, with 2 white wing bars; ♀ ashy gray with brownish yellow on head and rump; bill blackish. L. 8½. W. 4½. T. 4. Northeastern N. Am., S. in winter to D. C., in pine woods, etc. (Lat., *enucleator*, one who shells; *leucura:* Gr., *λευκός*, white; *οὐρά*, tail.) Subsp. **P. e. eschatosus** Oberholser occurs in Newfoundland.

672. CARPODACUS[1] Kaup (Gr., *καρπός*, fruit; *δάκος*, biting)

1092. **C. purpureus** (Gmelin). PURPLE FINCH. Everywhere streaky; ♂ flushed with red, most intense on the crown, fading below and behind; ♀ olive brown and streaky, with no red; bill stout. L. 6. W. 3⅓. T. 2½. C. and Northeast. N. Am., S. to Fla. A sweet singer. (Lat., *purpureus*, purple, which the bird is not.) A related species is the delightful House Finch of California (*C. mexicanus frontalis* [Say]).

673. LOXIA Linnaeus (Gr., *λοξός*, oblique)

a. Wing with white.

1093. **L. leucoptera** Gmelin. WHITE-WINGED CROSSBILL. ♂ rose red; 2 white wing bars; scapulars black; ♀ brownish olive, marked with dusky; rump yellow. L. 6¼. W. 3½. T. 2½. Northern N. Am., S. in winter to N. C.

[1] In the vicinity of *Carpodacus* perhaps belongs the Old World genus, **Passer** Brisson. (Lat., *passer*, a sparrow.)

P. domesticus (Linnaeus). ENGLISH SPARROW. EUROPEAN HOUSE SPARROW. ♂ chestnut brown above, thickly streaked; ashy below; throat, lores, and chin black; ♀ duller, without black; feet small. L. 6. W. 2¾. T. 2⅓. Introduced from Europe; abundant in towns E. and in most parts of U. S. A nuisance, unfortunately long past the possibility of elimination. (*Eu.*) (Lat., *domesticus*, domestic.)

P. montanus (Linnaeus). EUROPEAN TREE SPARROW. Smaller, with black of throat not continued over chest; top of head liver brown. L. 5½. W. 2¾. T. 2⅓. Europe, naturalized about St. Louis. (Lat., *montanus*, pertaining to mountains.)

and Colo. (*Eu.*, accid.) Less common, variable. (Gr., λευκός, white; πτερόν, wing.)

aa. Wing with no white.

1094. **L. curvirostra pusilla** Gloger. American Crossbill. Red Crossbill. ♂ brick red; wings dusky, unmarked; ♀ brownish, washed with greenish yellow. L. 6. W. 3⅓. T. 2½. Northern N. Am., about pine woods; S. in winter, sometimes in large flocks, to Fla. (Lat., *curvus*, curved; *rostrum*, beak; *pusillus*, very little.) Subsp. **L. c. percna** Bent occurs in Newfoundland. (Gr., περκνός, dark colored.) The singular bill is adapted for opening nuts.

674. LEUCOSTICTE Swainson (Gr., λευκός, white; στικτός, spotted)

1095. **L. tephrocotis** (Swainson). Gray-crowned Rosy Finch. Cinnamon brown; top of head more or less ashy gray; nasal tufts white; quills dusky; tail coverts edged with rose pink in adult. L. 6. W. 4. T. 3. W. U. S. and S. W. Canada, casually E. to Iowa. (Gr., τεφρός, gray; οὖς, ear.) Hepburn's Rosy Finch, **L. t. littoralis** Baird, has sides of head all gray. Pacific Coast, Northern N. Am., casually E. to Minn. (Lat., *litoralis*, belonging to the seashore.)

675. ACANTHIS Borkhausen (Gr., ἀκανθίς, linnet)

a. Crown red in both sexes, crimson in ♂, lustrous brownish-red in ♀; chin blackish; no yellow.

1096. **A. hornemanni exilipes** (Coues). Hoary Redpoll. Sides and rump scarcely streaked; colors very pale. ♂ with breast merely pinkish. L. 5. W. 3. T. 2½. Northern N. Am., S. to northern U. S. in winter. (To J. W. Hornemann; *exilipes:* Lat., *exilis*, small; *pes*, foot.)

1097. **A. linaria** (Linnaeus). Redpoll. Throat, breast, and rump rosy in ♂; much streaked above and on sides; rump streaked. L. 5¾. W. 3. T. 2½. Northern regions, S. in winter in flocks to Ind. and Va., casually Ala. (*Eu.*) (Lat., *linarius*, flaxen.) Besides the common form, a larger subsp., **A. l. rostrata** (Coues) (W. 3⅓, etc.), with larger, stouter bill, sometimes ranges S. from Greenland to Ill. and N. Y. (Lat., *rostratus*, beaked.) Subsp. **A. l. holboellii** (Brehm) strays southward to Ill. and Mass. (To C. Holböll.)

676. ASTRAGALINUS[1] Cabanis (Gr., ἀστραγαλῖνος, a goldfinch)

1098. **A. tristis** (Linnaeus). American Goldfinch. Yellowbird. Thistle Bird. Bill not very acute, no ruff at base. ♂ rich yellow; rump whitish; crown, wings, and tail black; wing bars white; a white spot on

[1] Allied to *Astragalinus* is the Goldfinch of Europe (*Carduelis carduelis* L.), several times unsuccessfully introduced into the U. S. In both sexes, the head is black and white, crimson anteriorly, the wings and tail black and yellow; the rump white; brownish below. Allied also is the Canary, *Serinus canarius*, a favorite cage bird.

outer pairs of tail feathers; ♀ more olivaceous; fall plumage pale yellow brown; young variously buffy, with yellow or not. L. 5. W. 3. T. 2. E. N. Am., everywhere except the far north. Notable for its lisping notes and undulating flight. (Lat., *tristis*, sad.)

677. SPINUS Koch (Gr., *σπίνος*, name of some finch)

1099. S. pinus (Wilson). Pine Siskin. Bill very sharp, with a ruff at base. Plumage streaky brown, suffused with yellow in the breeding season; bases of quills and tail feathers sulphur yellow. L. 4¾. W. 2¾. T. 2. N. Am., chiefly N., but likely to appear almost anywhere. (Lat., *pinus*, pine.)

678. PLECTROPHENAX Stejneger (Gr., *πλῆκτρον*, spur; *φέναξ*, an impostor)

1100. P. nivalis (Linnaeus). Snow Bunting. Snowflake. In breeding season, pure white, with black on back, wings, and tail; bill and feet black; only the winter plumage usually seen in U. S.; bill pale, and white of body clouded with clear, warm brown. L. 7. W. 4½. T. 3. Northern regions. S. in winter to Cal. and Fla. A most exquisite bird. (*Eu.*) (Lat., *nivalis*, snowy.)

679. CALCARIUS Bechstein (Lat., *calcar*, spur)

1101. C. lapponicus (Linnaeus). Lapland Longspur. ♂ with head and throat mostly black; a chestnut collar; back black and streaky; outer tail feathers with white; inner web of outer feather dusky; legs and feet black; ♀ and winter birds with less black. L. 6¼. W. 4. T. 2¾. Northern regions, S. in winter to Tex. and S. C. (*Eu.*) (Lat., *lapponicus*, of Lapland.)

1102. C. pictus (Swainson). Smith's Longspur. ♂ with head and upper parts mostly black; collar and under parts rich fawn-colored; legs pale; inner web of outer tail feather chiefly white. ♀ duller. L. 6½. W. 3¼. Central N. Am., S. to Tex. and S. C. (Lat., *pictus*, painted.)

1103. C. ornatus (Townsend). Chestnut-collared Longspur. ♂ chiefly black with rusty tinge; a chestnut collar; lesser wing coverts black; outer tail feathers white, the others largely so; ♀ without collar and with little or no black. Known by the tail feathers. L. 5¾. W. 3¼. T. 2¼. Central N. Am., N. to South-cent. Canada, S. to S. Mexico, E. to Me. and Md. (accid.). (Lat., *ornatus*, adorned.)

680. RHYNCHOPHANES Baird (Gr., *ῥυγχος*, beak; *φαίνω*, I appear)

1104. R. mccownii (Lawrence). McCown's Longspur. Crown and pectoral crescent black; the black often obscured by pale edgings; upper surface gray; bend of wing chestnut; line over eye and under parts white; back and sides streaked. L. 6½. W. 3¾. T. 2½. B. nearly ½. Great Plains, rarely E. to Ill. and W. to Brit. Col., S. to Northern Mex. (To Capt. J. P. McCown.)

681. POOECETES Baird (Gr., *πόα*, grass; *οἰκέτης*, inhabitant)

1105. **P. gramineus** (Gmelin). Vesper Sparrow. Bay-winged Bunting. Grass Sparrow. Ground Bird. Thickly streaked nearly everywhere; slightly buffy below. L. 6. W. 3. T. 2½. E. N. Am., S. to Yucatan; abundant in fields, known at once by the chestnut bend of wing and white outer tail feathers; a good singer. (Lat., *gramineus*, pertaining to grass.)

682. PASSERCULUS Bonaparte (Lat., diminutive of *passer*, a sparrow)

1106. **P. princeps** Maynard. Ipswich Sparrow. Grayish; streaks on back sandy brown, not sharply defined; superciliary line white in front; bill not longer than hind toe without claw. L. 6. W. 3¼. T. ½. Nova Scotia to Ga., coastwise. (Lat., *princeps*, chief.)

1107. **P. sandwichensis savanna** (Wilson). Savannah Sparrow. Sharply streaked; streaks on back blackish; superciliary line and edge of wing yellowish. L. 5½. W. 2¾. T. 2. E. N. Am., S. to N. E. Mexico and Cuba; abundant on plains and shores. (Lat., *sandwichensis*, from Sandwich Is., Alaska; Lat., *savanna*, to the city of Savannah, Ga.) The form in W. N. Am., E. to N. Dak., **P. s. alaudinus** Bonaparte, is paler. (Lat., *alaudinus*, lark-like.)

683. CENTRONYX Baird (Gr., *κέντρον*, a spur; *ὄνυξ*, claw)

1108. **C. bairdii** (Audubon). Baird's Sparrow. Head ochraceous, streaked with black; rest of upper parts varied with brownish and blackish; lower parts whitish, somewhat streaked with blackish. L. 5½. W. 2⅞. T. 2⅛. Great Plains, Sask., Manitoba, and N. W. Minn.; S. in winter to northern Mex.; accid. on Long Island, N. Y. (To S. F. Baird.)

684. AMMODRAMUS Swainson (Gr. *ἄμμος*, sand; *δραμεῖν*, to run)

1109. **A. savannarum australis** Maynard. Grasshopper Sparrow. Much streaked above; feathers edged with bay; breast buffy, unstreaked; wings and tail short; edge and bend of wing, and line over eye yellow. L. 5. W. 2⅓. T. 2. Southeast. N. Am., S. to Yucatan, in fields. Notes sharp, grasshopperlike. (Lat., *savannarum*, from Spanish, *sabana*, a plain; Lat., *australis*, southern.) The form west of Miss. R. in the U. S., **A. s. bimaculatus** (Swainson), is paler, with a smaller bill. (Lat., *bimaculatus*, two-spotted.)

685. NEMOSPIZA Oberholser (Gr., *νέμος*, a pasture; *σπίζα*, a finch)

1110. **N. henslowii** (Audubon). Henslow's Sparrow. Smaller than preceding; head more greenish; breast, etc., with some sharp black streaks. L. 5. W. 2¼. T. 2⅛. U. S., scarce; N. to S. Ontario, S. to Tex. and Fla. (To Prof. J. S. Henslow.) The bird of E. U. S., north to N. H., **N. h. susurrans** (Brewster), is darker, with larger bill. (Lat., *susurrans*, buzzing.)

686. PASSERHERBULUS Stone (Lat., *passer*, a sparrow; *herbula*, a little herb)

1111. **P. leconteii** (Audubon). Le Conte's Sparrow. Upper parts streaked, buffy, black, and whitish; crown with black lateral stripes; no yellow on edge of wing; under parts whitish or buffy, with blackish streaks on sides. L. 5. W. $1\frac{9}{10}$. T. $2\frac{1}{8}$. Central N. Am., from N. Canada to Minn.; in winter to Tex. and casually to S. C. (To Major J. Le Conte.)

687. AMMOSPIZA Oberholser (Gr., *ἄμμος*, sand; *σπίζα*, a finch)

1112. **A. caudacuta** (Latham). Sharp-tailed Sparrow. Brownish olive, the back streaked with whitish and buffy; edge of wing pale yellow; under parts whitish or buffy, sharply streaked with dusky. L. $5\frac{1}{4}$. W. $2\frac{1}{4}$. T. 2. Salt marshes, Mass. to Va., in winter to Fla. (Lat., *caudacutus: cauda*, tail; *acutus*, sharp.) A more northern form, paler and less sharply streaked, **A. c. subvirgata** (Dwight), breeds from S. E. Quebec to Me. and winters S. to Fla. (Lat., *subvirgatus: sub*, somewhat; *virgatus*, striped.) An interior form is **A. c. nelsoni** (Allen), which has colors of upper parts very sharply contrasted, and breast less sharply streaked; breeds from Mackenzie to South Dak. and winters S. to Tex. and Fla.; E. in migration to Mass. (To Edward W. Nelson.)

688. THRYOSPIZA Oberholser (Gr., *θρύον*, reed; *σπίζα*, a finch)

1113. **T. maritima** (Wilson). Seaside Sparrow. Olive gray; back obscurely streaked; a yellow spot before eye; edge of wing yellow; no superciliary stripe. L. 6. W. $2\frac{1}{3}$. T. 2. Salt marshes, Mass. to Fla. Other subspecies range to Texas. (Lat., *maritimus*, maritime.)

689. CHONDESTES Swainson (Gr., *χόνδρος*, grain; *ἐδεστής*, eater)

1114. **C. grammacus** (Say). Lark Sparrow. Streaked above, grayish white below; ear coverts chestnut; crown chestnut, black anteriorly, with whitish median and superciliary stripes; a black line through and below eye; a conspicuous black streak on each side of the white throat; a black pectoral spot; middle tail feathers like back, the rest blackish, white tipped; a pale spot on primaries. L. $6\frac{1}{2}$. W. $3\frac{1}{2}$. T. 3. Central U. S., E. to Ohio, casually to Nova Scotia; abundant on prairies and river bluffs. A fine songster. (Gr., *γραμμικός*, consisting of lines, i.e., streaked.)

690. ZONOTRICHIA Swainson (Gr., *ζώνη*, band; *θρίξ*, hair; i.e., head)

a. No yellow markings anywhere.

1115. **Z. querula** (Nuttall). Harris's Sparrow. Crown, face, and throat jet black; no yellow; ♀ with less black. L. $7\frac{1}{2}$. W. $3\frac{1}{4}$. T. $3\frac{1}{2}$. Cent. N.

Am., S. to Tex., E. casually to Ohio and W. to Brit. Col. (Lat., *querulus*, plaintive.)

1116. **Z. leucophrys** (Forster). White-crowned Sparrow. Streaked above, with but little chestnut; crown black, with a broad, white median band; lores blackish; a white superciliary streak; grayish white below, but paler on chin and abdomen; young with the crown chiefly rich brown. L. 7. W. 3¼. T. 3¼. C. and E. N. Am., S. to La. and central Mex.; not rare. (Gr., λευκός, white; ὀφρύς, eyebrow.)

1117. **Z. gambelii** (Nuttall). Gambel's Sparrow. Like the preceding, but with lores entirely white. W. N. Am., S. to Mex., casual E. to Wisc. (To Dr. W. Gambel.)

aa. Head with yellow.

1118. **Z. coronata** (Pallas). Similar to *Z. leucophrys*, but the crown-stripe yellow anteriorly, ashy behind. L. 7½. W. 3½. T. 3⅓. W. N. Am., S. to L. Cal., rarely E. to Wisc. (Lat., *coronatus*, crowned.)

1119. **Z. albicollis** (Gmelin). White-throated Sparrow. Peabody Bird. Much chestnut streaking above; crown black, with white median and superciliary stripes; spot over eye and edge of wing always yellow; pale ashy below, throat white; ♀ duller. L. 7. W. 3. T. 3⅓. E. and cent. N. Am., S. to Fla. and northern Mex., straying W. to Cal. An abundant and handsome sparrow. (Lat., *albus*, white; *collum*, neck.)

691. SPIZELLA Bonaparte (Lat., diminutive of Gr., σπίζα, a finch)

1120. **S. arborea** (Wilson). Tree Sparrow. Streaked above; crown chestnut; bill black above, pale below; neck, line over eye, and under parts pale ashy gray; a dark pectoral blotch; white wing bars distinct. L. 6¼. W. 3. T. 3. Cent. and east. N. Am., chiefly northerly; E. U. S. in winter, S. to S. C. (*S. monticola* [Gmelin].) (Lat., *arboreus*, of a tree.)

1121. **S. passerina** (Bechstein). Chipping Sparrow. Chippy. Streaked above, with much dull bay; crown chestnut; forehead and streak through eye black; ashy white below; bill blackish; wing bars faint, brownish. L. 5¼. W. 2⅔. T. 2⅓. Cent. and east. N. Am., casual S. to Cuba and N. E. Mex.; common. (*S. socialis* Wilson.) (Lat., *passerinus*, of a sparrow.)

1122. **S. pusilla** (Wilson). Field Sparrow. General color of *S. arborea*, but paler and duller; bill pale; no pectoral blotch; wing bands obscure, whitish. L. 5½. W. 2⅓. T. 2⅓. E. N. Am., N. to S. E. Canada, S. to Gulf Coast; abundant. (Lat., *pusillus*, very little.)

1123. **S. pallida** (Swainson). Clay-colored Sparrow. Above pale brownish buff, streaked with black; crown grayish, with median stripe; lower parts white. L. 5½. W. 2⅓. T. 2⅓. Cent. N. Am., S. to S. Mexico, rarely E. to Ind. and Ont. (Lat., *pallidus*, pale.)

692. JUNCO Wagler (Lat., *juncus*, a rush)

1124. **J. hyemalis** (Linnaeus). Slate-colored Junco. Snowbird. Slaty gray; head darker; bill pale; belly and outer tail feathers white; ♀ more grayish; L. 6¼. W. 3. N. and E. N. Am., everywhere abundant E., breeding in cold regions, and moving S. as cold weather approaches, usually in advance of the snow, to Gulf Coast; casual in Cal. (Lat., *hyemalis*, of winter.) Represented W. by numerous forms, or geminate species. Subsp. **J. h. carolinensis** Brewster, is larger and more uniform above. Allegheny Mts., from Md. to Ga. (Lat., *carolinensis*, Carolinian).

1125. **J. oreganus montanus.** Montana Junco. Like preceding, but back grayish brown, sides and flanks pinkish. L. 6. W. 3. W. N. Am., Alberta to Mont. and Idaho; in winter to Northern Mex., casual E. to Mass. (Lat., *oreganus*, of the Oregon (i.e., Columbia) River; *montanus*, pertaining to the mountains.)

693. PEUCAEA Audubon (Gr., πευκή, pine)

1126. **P. aestivalis bachmani** (Audubon). Upper parts largely chestnut, with ashy edgings and dusky streaks; a broad pale superciliary line; pale ashy below, the breast buffy; yellow on bend and edge of wing, but none on head. L. 6. W. 2⅓. T. 2½. Southeastern U. S., N. to Iowa and S. Md. (Lat., *aestivalis*, of summer; *bachmani*, to John Bachman.)

694. MELOSPIZA Baird (Gr., μέλος, song; σπίζα, a finch)

1127. **M. melodia** (Wilson). Song Sparrow. Brown and gray above; much streaked above and on breast and sides; crown with an obscure ashy median stripe; below white, pectoral streaks often forming a dusky blotch. L. 6½. W. 2½. T. 3. E. N. Am., from S. Can. to Fla., with numerous subsp. W. A hearty little songster, beginning early in spring. (Lat., *melodia*, a melody.) A larger, rather paler race, **M. m. juddi** Bishop, occurs in the Great Plains region, E. to Minn. (To E. T. Judd.) Another, **M. m. atlantica** Todd, occupies the coast marshes, N. C. to R. I. (Lat., *atlanticus*, of the Atlantic Ocean.)

1128. **M. georgiana** (Latham). Swamp Sparrow. Crown bright dark chestnut, often streaked with black; wings strongly tinged with chestnut; back brown, sharply streaked; an ashy collar and superciliary line; breast and below ashy with few streaks or none; tail shorter than in the Song Sparrow, its quills edged with chestnut. L. 5¾. W. 2⅓. T. 2⅓. Cent. and east. N. Am., S. to Gulf Coast and cent. Mex., in low thickets. A timid bird, seldom seen, although not rare. (Lat., *georgiana*, of Georgia.)

1129. **M. lincolnii** (Audubon). Lincoln's Sparrow. Everywhere above and below thickly and sharply streaked with black, gray, and buffy; breast with a broad band of pale buffy or yellowish brown; sides washed with buffy.

L. 5½. W. 2½. T. 2½. N. Am., rare E., accid. S. to Panama. A shy species, quite unlike the Song Sparrow. (To Robert Lincoln.)

695. PASSERELLA Swainson (Lat., diminutive of *passer*, a sparrow)

1130. **P. iliaca** (Merrem). Fox Sparrow. Ashy above, overlaid and much streaked with rusty red, which becomes bright bay on rump, tail, and wings; white below with large arrow-shaped spots and streaks, numerous on breast; feet stout, with long claws. L. 7. W. 3½. T. 3. North. N. Am., S. to Tex. and Fla., migrating early. One of the handsomest streaked sparrows, and a good singer. (Lat., *iliacus*, relating to the *ilium*, flank, which is streaked.)

696. PIPILO Vieillot (Lat., *pipilo*, I peep or chirp)

a. Color of ♂ black, white, and chestnut.

1131. **P. erythrophthalmus** (Linnaeus). Chewink. Towhee. Marsh Robin. Black, belly white; sides chestnut; outer tail feathers, primaries, and inner secondaries with white; no white spots on scapulars or wing coverts. ♀ with clear brown instead of black; iris red. L. 8½. W. 3½. T. 4. East. N. Am., from S. E. Canada to Gulf Coast; common everywhere. (*erythrophthalmus:* Gr., ἐρυθρός, red; ὀφθαλμός, eye.)

1132. **P. maculatus arcticus** (Swainson). Arctic Towhee. Color much like the eastern Towhee. Scapulars and wing coverts with white spots; sexes more alike; the voice very different, more like the call of the Catbird. Great Plains and Rocky Mts. region, from cent.-south. Canada to S. Tex. Casual E. to Ill. With many subsp. in the West. (Lat., *maculatus*, spotted; *arcticus*, arctic.)

697. RICHMONDENA Mathews

(To Charles Wallace Richmond) (*Cardinalis* Bonaparte, the name preoccupied for a Tanager)

1133. **R. cardinalis** (Linnaeus). Cardinal. Cardinal Grosbeak. Redbird. Clear red, ashy on back; chin and forehead black, crest conspicuous; ♀ ashy brown, more or less washed with red. L. 8½. W. 4. T. 4½. E. U. S., S. to Ga., N. to S. Ont. and N. B.; abundant. A brilliant songster. (Lat., *cardinalis*, red, from the color of a cardinal's hat.)

698. HEDYMELES Cabanis (*Zamelodia* Coues)
(Gr., ἡδύς, sweet; μέλος, a song)

1134. **H. lud vicianus** (Linnaeus). Rose-breasted Grosbeak. ♂ with head, neck, and upper parts mostly black, with white on rump, wings, and tail; belly white; breast and under wing coverts of an exquisite rose red; bill

very stout, pale; ♀ olive brown, much streaked, with the under wing coverts saffron yellow; head with whitish stripes. L. 8½. W. 4. T. 3¼. N. E. Am., N. W. to south-cent. Mackenzie, S. to Ecuador, accid. W. to Cal. One of our handsomest birds and finest songsters. (Lat., *ludovicianus*, Louisianian.)

1135. **H. melanocephalus papago** Oberholser. Black-headed Grosbeak. Chiefly black, varied with whitish and brownish, but with no red; neck and under parts orange brown, yellow posteriorly. Western N. Am., from C. S. Canada to S. Mex. E. to Neb., in thickets along streams. A good singer. (*melanocephalus:* Gr., μέλας, black; κεφαλή, head; *papago*, name of an Arizona Indian tribe.)

699. GUIRACA Swainson (S. Am. name)

1136. **G. caerulea** (Linnaeus). Blue Grosbeak. ♂ rich blue; feathers about bill, wings, and tail black; wing bars chestnut; ♀ yellowish brown, with whitish wing bars. L. 7. W. 3½. T. 2¾. E. N. Am., N. to S. E. Canada, S. to Honduras; rare in north. A fine musician. (Lat., *caeruleus*, blue.)

700. PASSERINA Vieillot (Lat., *passer*, a sparrow; + *ina*)

(*Cyanospiza* Baird)

1137. **P. cyanea** (Linnaeus). Indigo Bunting. Indigo Bird. ♂ indigo-blue, clear on head, slightly greenish behind; ♀ plain warm brown, obscurely streaky, known from other small sparrows usually by a dusky line along the gonys. L. 5¾. W. 3. T. 2¾. E. N. Am., N. to S. E. Canada, S. to Panama; common in summer. A tireless songster. (Lat., *cyaneus*, dark blue.)

1138. **P. ciris** (Linnaeus). Painted Bunting. Nonpareil. ♂ head and neck blue; rump and under parts vermilion; back and shoulders green; tail purplish brown; ♀ green, yellowish below. L. 5½. W. 2⅔. T. 2½. Southeast. N. Am., W. to S. Ill. and Tex., S. to Panama. (Gr., κίρις, ancient name of some bird.)

701. SPIZA Bonaparte (Gr., σπίζα, a finch)

1139. **S. americana** (Gmelin). Dickcissel. Black-throated Bunting. Grayish and streaked above; wing coverts chestnut; line over eye, maxillary stripe, edge of wing, breast, and part of belly yellow; throat patch black; otherwise white below; ♀ with little chestnut, and the black reduced to dark streaks. L. 6¾. W. 3¼. T. 2¾. Cent. and S. E. Canada, S. to Venezuela, rare in E. U. S. A handsome bird, with sleek plumage and a peculiar, scarcely musical song, incessantly repeated in hot weather in the prairies. (Lat., *americanus*, American.)

702. CALAMOSPIZA Bonaparte (Gr., κάλαμος, a reed; σπίζα, a finch)

1140. **C. melanocorys** Stejneger. Lark Bunting. White-winged Blackbird. ♂ black, with a large white wing patch and white on wing quills;

♀ streaky, like the ♀ bobolink, known by the whitish wing patch and long tertials. L. 6½. W. 3½. T. 2¾. Plains of cent. N. Am. from cent.-south. Canada to cent. Mex.; occasional E. to Mass. (Gr., *μέλας*, black; *κόρυς*, helmet.)

Family CCXIX. THRAUPIDAE[1] (The Tanagers)

Primaries 9; bill usually conical, sometimes depressed or attenuate, the culmen curved; cutting edges not much angulated, sometimes toothed, notched or serrated; tarsus scutellate; legs short; claws long. Colors usually brilliant. A large family of more than 300 species, confined to the warmer parts of America, and embracing a wide diversity of forms. Some have slender bills and are scarcely distinguishable from the Warblers, and might well be referred to the same family. Others, like our *Piranga*, have stout conical bills, and are closely related to the Finches. (Gr., *θραυπίς*, name of some bird.)

a. Bill stout, finch-like, considerably longer than broad, and more or less evidently toothed or lobed near middle of upper mandible. . . . . Piranga, 703.

703. PIRANGA Vieillot (S. Am. name)

1141. P. **rubra** (Linnaeus). Summer Tanager. ♂ bright rose red throughout; wings a little dusky; ♀ dull brownish olive above, dull yellowish below; no wing bars; bill and feet paler than in the Scarlet Tanager. L. 8. W. 4. T. 3½. E. U. S., chiefly S.; N. to Quebec and Ont.; S. to Peru. (*P. aestiva* [Gmelin].) (Lat., *ruber*, red.)

1142. P. **olivacea** (Gmelin). Scarlet Tanager. ♂ brilliant scarlet; wings and tail black; no wing bars; ♀ clear olive green; clear greenish yellow below. L. 7. W. 3¾ B. T. 3. E. N. Am., N. to S. E. Canada; S. to Bolivia; in woodlands. A most beautiful bird and a respectable songster. (*P. erythromelas* Vieillot; the name *olivacea* is unfortunately applicable only to females and young.) (Lat., *olivaceus*, olivaceous.)

1143. P. **ludoviciana** (Wilson). Louisiana Tanager. Western Tanager. ♂ bright yellow; back, wings, and tail black; head crimson; wings with 2 yellow bars. ♀ dull olive and yellow, but marked with pale wing bars. Western N. Am., S. to Guatemala; occasional E. to Me. (Lat., *ludovicianus*, Louisianian.)

Family CCXX. HIRUNDINIDAE (The Swallows)

Primaries 9, the first being obsolete; bill "fissirostral"; i.e., short, broad, triangular, depressed, the gape wide and about twice as long as the culmen, reaching to about opposite the eyes, similar in its form to that of the Swifts and the Goatsuckers, with which birds the Swallows have no real affinity. Rictus

[1] The proper name, since the typical genus of this family is *Thraupis*, not *Tanagra*.

without bristles; wings very long and pointed, the first primary usually longest, and twice as long as the last; secondaries very short. Tail more or less forked. Feet weak; tarsus scutellate, shorter than middle toe and claw. Plumage compact, and more or less lustrous.

A very natural family of numerous species, found in all parts of the world. All are strong on the wing, insectivorous, and in our latitude migratory.

a. Nostrils opening directly upward, with very little membrane bordering inner edge.
b. Tail forked for a distance of more than half tarsus; bill very stout, curved, (plumage lustrous, ♂ all black) . . . . . PROGNE, 704.
bb. Tail even.
c. Outer web of outer primary without recurved hooks; (plumage lustrous). PETROCHELIDON, 705.
cc. Outer web of outer primary with stiff recurved hooks, obscure in ♀; (plumage plain brown). . . . . STELGIDOPTERYX, 709.
aa. Nostril opening laterally, and bordered above by a broad membrane or overhanging scale.
d. Tail forked for more than half its length, the outer feathers very narrow toward tip; no tarsal tuft. . . . . HIRUNDO, 706.
dd. Tail forked for less than half its length.
e. Tarsus without tuft of feathers on its lower part; (plumage of adult lustrous above). IRIDOPROCNE, 707.
ee. Tarsus with a small tuft of feathers on its lower part; (plumage plain brownish). RIPARIA, 708.

704. PROGNE Boie (Gr., Πρόκνη, daughter of Pandion, fabled to have been turned into a swallow)

1144. **P. subis** (Linnaeus). PURPLE MARTIN. Lustrous blue black throughout; ♀ duller, whitish and streaky below. L. 7½. W. 6. T. 3⅛. U. S. to S. Canada, S. to Brazil; locally abundant. (*Eu.*) (Lat., *subis*, old name of some bird.)

705. PETROCHELIDON Cabanis (Gr., πέτρα, rock; χελιδών, a swallow)

1145. **P. albifrons** (Rafinesque). CLIFF SWALLOW. EAVES SWALLOW. Lustrous steel blue; forehead, sides of head, throat, rump, etc., of various shades of chestnut and buff; a bluish spot on breast; belly whitish. L. 5⅛. W. 4½. T. 2⅛. N. Am., S. to Southern S. Am., locally abundant, formerly nesting in cliffs, but now building under the eaves of barns. (Lat., *albifrons: albus*, white; *frons*, forehead.)

706. HIRUNDO Linnaeus (*Chelidon* Forster) (Lat., *hirundo*, a swallow)

1146. **H. rustica erythrogastris** Boddaert. BARN SWALLOW. Lustrous steel blue above, rusty or buffy below; forehead and throat deep chestnut; an imperfect steel blue collar; tail feathers with white spots. L. 7. W. 5. T. 4½. N. Am., S. to Chile; abundant; breeding in colonies about barns, etc. (Lat., *rusticus*, of the country; *erythrogastris:* Gr., ἐρυθρός, red; γαστήρ, abdomen.)

707. IRIDOPROCNE Coues (Gr., Ἶρις, the rainbow; Πρόκνη, daughter of Pandion)

1147. **I. bicolor** (Vieillot). Tree Swallow. White-bellied Swallow. Lustrous dark blue or green, pure white below. ♀ duller. L. 6¼. W. 5. T. 2⅔. N. Am., S. to Guatemala and Cuba. (*Eu.*, accid.) Abundant about water. (Lat., *bicolor*, two-colored.)

708. RIPARIA Forster (Lat., *riparius*, riparian)

1148. **R. riparia** (Linnaeus). Bank Swallow. Sand Martin. Dark gray, not iridescent above; white below, a brown band across the breast. L. 4¾. W. 4. T. 2. N. Am., S. to S. Am.; abundant, breeding in holes in sand banks. (*Eu.*)

709. STELGIDOPTERYX Baird (Gr., στελγίς, scraper; πτέρυξ, wing)

1149. **S. serripennis** (Audubon). Rough-winged Swallow. Brownish gray, pale below. L. 5⅓. W. 4½. T. 2¼. N. Am., S. to Costa Rica, common in Middle West, breeding in banks, etc. (Lat., *serra*, saw; *penna*, feather.)

Family CCXXI. BOMBYCILLIDAE (The Waxwings)

Primaries 10, or apparently 9, the first in our species rudimentary and displaced; bill stout, triangular, depressed, decidedly notched and hooked, with the gape very wide. Tarsus short, with the lateral plates more or less subdivided, their covering often unlike that of the other *Oscines;* lateral toes nearly equal. As now recognized, a small family of 3 species.

Our species are crested birds with soft plumage of a handsome cinnamon-drab color; the ends of the secondaries, and sometimes of the tail feathers also, are tipped with horny appendages, looking like red sealing wax; these often absent. The tail in all the species is tipped with yellow or red. The species are migratory and gregarious, feeding on insects and soft fruits. Their voices are weak and wheezy; they can scarcely be considered as songsters.

a. Wings pointed; tail short, truncate; primaries apparently 9; the first very minute; no rictal bristles; nostrils concealed by bristles. . . . . Bombycilla, 710.

710. BOMBYCILLA Vieillot (Lat., *bombyx*, something made of silk; *cilla*, tail)

1150. **B. garrula pallidiceps** Reichenow. American Waxwing. General color a soft silky, ashy brown; front and sides of head, also crissum, cinnamon; a pale-edged black band across forehead through eye, around crest; throat black; 2 broad white wing bars. L. 7⅓. W. 4½. T. 3. Northern N. Am.,

S. in winter, sometimes in large flocks, to the Great Lakes, casually to Ariz. and Pa. An interesting and beautiful bird. (Lat., *garrulus*, loquacious; *pallidiceps*, pale-headed.)

1151. **B. cedrorum** Vieillot. Cedar Waxwing. Cedar Bird. Cherry Bird. Similar but smaller and less cinnamon-tinged; chin black; stripe across face black, bordered above by whitish; belly yellowish posteriorly; crissum white; no wing bars; young with the wax-like appendages small or wanting. L. 6½. W. 3¾. T. 2½. N. Am., from S. Canada, S. to Panama. (*Eu.*, accid.) (Lat., *cedrorum*, of the cedars; *cedrus*, the cedar.)

Family CCXXII. LANIIDAE (The Shrikes)

Primaries 10, the first short (rarely wanting); bill hawk-like, very strong, the upper mandible toothed and abruptly hooked at the tip; both mandibles distinctly notched. Wings short, rounded. Tail long. Tarsus scutellate on the outside as well as in front. Sexes alike.

Species numerous, found in many parts of the world, remarkable for their vigor and pugnacity. Their habits, corresponding with the form of the bill, are similar to those of birds of prey. They have a remarkable habit of impaling small animals on thorns and leaving them there.

a. Rictus with bristles; nostrils concealed by bristly tufts; first primary not very short. Lanius, 711.

711. LANIUS Linnaeus (Lat., *lanius*, butcher)

1152. **L. borealis** Vieillot. Northern Shrike. Butcher Bird. Ashy above; black bars on side of head narrow, *not* meeting in front, and interrupted by a white crescent on under eyelid; rump and shoulders whitish; wings and tail black, outer tail feathers with white; white below, waved with dusky. L. 9½. W. 4¼. T. 4¾. N. N. Am., S. in winter to N. C. and Tex. (Lat., *borealis*, northern.)

1153. **L. ludovicianus migrans** Palmer. Migrant Shrike. Above slate gray or ash gray; black bars on sides of head broad, meeting across forehead; no white on under eyelid; adults white below, not dark-waved. L. 9. W. 3¾. T. 4. Middle and N. E. U. S., N. to Minn. and S. Quebec. A paler form, **L. l. excubitorides** Swainson, the White-rumped Shrike, is common in cent.-west. N. Am., E. to N. D. This has the upper tail coverts whitish. L. 9. W. 4. T. 4. (Lat., *ludovicianus*, Louisianian; *migrans*, migrant.)

Family CCXXIII. VIREONIDAE (The Vireos)

Primaries 10, or apparently only 9, the first being rudimentary and displaced. Bill shorter than head, stout, compressed, decidedly notched and hooked. Rictus with bristles. Nostrils exposed, overhung by a scale, reached by the

bristly frontal feathers. Tarsus scutellate; toes soldered at base for the whole length of basal joint of middle one, which is united with the basal joint of the inner and the 2 basal joints of the outer; lateral toes usually unequal.

A rather small family, comprising about 75 species of small olivaceous birds, all American. They are allied to the *Laniidae*, being in fact small insectivorous Shrikes. The coloration is usually blended, and varies little with age or sex. Many of them are remarkable as songsters.

Concerning the "nine-primaried" species, Professor Baird remarks:

"In *V. flavifrons*, in which the outer primary is supposed to be wanting, its presence may be easily appreciated. One of the peculiar characters of this species consists in a narrow edging of white to all the primary quills, while the primary coverts (the small feathers covering their bases, as distinguished from what are usually termed the wing coverts, which more properly belong to the forearm or secondaries) are without them. If these coverts are carefully pushed aside, two small feathers considerably shorter than the others will be disclosed, one overlying the other, which (the under one) springs from the base of the exposed portion of the long outermost primary, and lies immediately against its outer edge. This small feather is stiff, falcate, and edged with white like the other quills, and can be brought partly around on the inner edge of the large primary, when it will look like any spurious quill. The overlying feather is soft, and without light edge. In the other Vireos, with appreciable spurious or short outer primary, a similar examination will reveal only one small feather at the outer side of the base of the exterior large primary. In all the families of *Passeres*, where the existence of nine primaries is supposed to be characteristic, I have invariably found, as far as my observations have extended, that there were two of the small feathers referred to, while in those of ten primaries but one would be detected."

a. Wings long and pointed, ½ or more longer than tail; 1st primary very small or apparently wanting, not ¼ second.

b. Slender species; bill slender, light horn color, pale below; commissure straight and culmen relatively so; feet weak; no wing bars nor conspicuous orbital ring. VIREOSYLVA, 712.

bb. Stout species; the bill short and thick, blue-black; feet robust; (a pale stripe to and around eye; 2 white wing bars; quills blackish, mostly edged with pale). LANIVIREO, 713.

aa. Wings relatively short and rounded, not ¼ longer than tail; 1st primary ⅔ or more length of 2d, bill stout. . . . . VIREO, 714.

712. VIREOSYLVA Bonaparte (Genus *Vireo* + Lat., *sylva*, forest)

a. Primaries apparently 9, the 1st being rudimentary and displaced.

1154. **V. olivacea** (Linnaeus). RED-EYED VIREO. RED-EYED GREENLET. Olive green, crown ashy, edged on each side with blackish; a white superciliary line, and below this a dusky streak; white below, somewhat olive-shaded; iris red. L. 6. W. 3⅓. T. 2½. Temperate N. Am., S. to Brazil; abundant in woodlands. An energetic songster. (Lat., *olivaceus*, olivaceous.)

1155. **V. philadelphica** (Cassin). PHILADELPHIA VIREO. Dull olive green, becoming ashy on crown; no black lines on head; a whitish superciliary line; below faintly yellowish, fading to white on throat. L. 4¾. W. 2⅔. T. 2¼. E. N. Am., from N. Alberta S. to Panama; scarce. (Lat., *philadelphicus*, of Philadelphia.)

cc. Primaries evidently 10, the 1st well developed.

1156. **V. gilva** (Vieillot). Warbling Vireo. Colors nearly as in the preceding, but less yellowish below, and the spurious quill evident. L. 5½. W. 2¾. T. 2¼. E. N. A., from N. Manitoba to E. U. S. and southward; an exquisite songster, nesting often in tall trees in cities. (Lat., *gilvus*, yellowish.)

713. LANIVIREO Baird (Genus *Lanius* + *Vireo*)

a. Primaries 9, the 1st obsolete.

1157. **L. flavifrons** Vieillot. Yellow-throated Vireo. Rich olive green; ashy on rump; bright yellow anteriorly below; belly white; a yellow line to and around eye. L. 5¾. W. 3. T. 2. E. N. Am., N. to S. E. Canada, and S. to Colombia; common. The most brightly colored of the North American vireos. (Lat., *flavifrons: flavus*, yellow; *frons*, forehead.)

aa. Primaries evidently 10, the 1st small but distinct.

1158. **L. solitarius** (Wilson). Blue-headed Vireo. Solitary Vireo. Bright olive green; crown and sides of head bluish ash; stripe to and around eye white; a dusky line below it; white below, washed with yellow. L. 5¾. W. 3. T. 2⅓. Cent. and E. N. Am., N. to Mackenzie, S. to Guatemala; in woodlands. A handsome species. (Lat., *solitarius*, solitary.) Subsp. **L. s. alticola** (Brewster) is a larger form, darker, more grayish above, in the Allegheny Mts. region, from Md. to S. C.; in winter to Fla. (Lat., *alticola: altum*, a height; *incola*, an inhabitant.)

714. VIREO Vieillot (Lat., *vireo*, I am green)

1159. **V. griseus** Boddaert. White-eyed Vireo. Bright olive green, white below; sides and crissum bright yellow; pale wing bars; stripe from bill to and around eye, yellow; iris white. L. 5. W. 2⅓. T. 2¼. S. E. Canada; E. U. S., and S. to Guatemala, in thickets. A sprightly bird, with a loud and varied song. (Lat., *griseus*, gray.)

1160. **V. bellii** Audubon. Bell's Vireo. Olive green, yellowish below, chin, middle of belly, and superciliary line whitish; wing bars whitish. L. 4¼. W. 2⅛. T. 2. Cent. U. S., E. to Ind., accid. to N. H., W. to Colo., S. to Guatemala. (To J. G. Bell.)

Family CCXXIV. COMPSOTHLYPIDAE (The Wood Warblers) (*Sylvicolidae*, *Mniotiltidae*, of authors)

Primaries 9; inner secondaries not enlarged, nor the hind toe long and straight, as in *Alaudidae* and *Motacillidae*. Bill usually rather slender, notched or not; the commissure not angulated at base, as in *Fringillidae*, nor toothed in

the middle, as in some *Thraupidae;* the end not notched and abruptly hooked, as in *Vireonidae* and *Laniidae;* the gape not broad and reaching the eyes, as in *Hirundinidae.*

The Warblers are small birds; all, except *Icteria,* are less than 6½ inches in length, and very many are less than 5. The colors are usually brilliant and variegated, but the sexes are usually unlike, and the variations due to age and season are great, so that the identification of immature birds is often very difficult. Many of the Warblers are pleasing songsters, but none have any remarkable powers in that line. The name "Warbler" comes from their resemblance to the warblers of Europe (*Sylviidae*) and not from any distinguished musical quality of their own. All are insectivorous and migratory.

This family consists of more than 150 species, all American. The *Compsothlypidae* seem to grade into the *Coerebidae* and *Thraupidae,* and the last as fully into the *Fringillidae.*

a. Bill not depressed and flycatcher-like; rictal bristles if present scarcely reaching beyond nostrils.
  b. Bill rather slender, little compressed; (small birds; length less than 6½).
    d. Hind toe with claw very long, as long as tarsus in front; claw of middle toe in same line as axis of the toe; (color black and white, no yellow). . . MNIOTILTA, 715.
    dd. Hind toe with claw much shorter than naked portion of tarsus in front; claw of middle toe (seen from above) set obliquely to axis of the toe.
      e. Middle toe with claw not shorter than tarsus; (no white wing bars); bill rather long.
        f. (Tail feathers blotched with white.) . . . . . PROTONOTARIA, 716.
        ff. (Tail feathers without white.)
          g. Bill very much compressed; culmen straight, with a ridge at base. LIMNOTHLYPIS, 717.
          gg. Bill slightly compressed; culmen gently curved, the basal portion not ridged. HELMITHEROS, 718.
      ee. Middle toe with claw decidedly shorter than naked portion of tarsus in front (except in *Dendroica dominica,* a species with white wing bars).
        h. Rictus without bristles; bill very acute, scarcely notched; (tail feathers with or without white). . . . . VERMIVORA, 719.
        hh. Rictus with bristles.
          i. Tail scarcely rounded, usually much shorter than wing; (tail blotched with white or with the inner web bright yellow; legs and feet moderate, usually dark colored).
            j. Hind toe evidently longer than its claw; bill acute, not notched. COMPSOTHLYPIS, 720.
            jj. Hind toe scarcely longer than its claw; bill usually not very acute, and with a slight notch toward its tip. . . . . DENDROICA, 721.
          ii. Tail usually more or less rounded, not very much shorter than wing; legs and feet strong, usually pale; (no white or bright yellow on tail feathers).
            k. Length 6 inches or more; (lower parts much streaked). . . SEIURUS, 722.
            kk. Length less than 6 inches; (lower parts not streaked).
              l. Tail evidently shorter than wing, more than half hidden by the coverts. OPORORNIS, 723.
              ll. Tail not shorter than wing, its feathers not half concealed by coverts. GEOTHLYPIS, 724.
  bb. Bill stout, much compressed, its greatest depth half its length from nostril to tip; outer side of tarsus smooth on its upper half; tail longer than wings; bill without notch or bristles; (large, more than 7 inches long). (Chats.) . . . . . ICTERIA, 725.
aa. Bill depressed, broader than deep at base, notched and slightly hooked, with strong rictal bristles about half the length of bill; length 5½ or less. (Fly-catching Warblers.)
  l. Bill fully twice as long as wide at base; tail a little shorter than wings. WILSONIA, 726.

ll. Bill scarcely twice as long as wide at base, formed much as in a Flycatcher; tail about as long as wings. . . . . SETOPHAGA, 727.

715. MNIOTILTA Vieillot (Gr., *μνίον*, moss; *τιλτός*, plucked)

1161. **M. varia** (Linnaeus). BLACK-AND-WHITE WARBLER. BLACK-AND-WHITE CREEPER. Everywhere black and white, streaked; crown with a broad white stripe; wing bars white; ♀ similar, grayer. L. 5. W. 2¾. T. 2¼. East. and cent. N. Am., and S. to Ecuador, not rare. A beautiful warbler, with the habits of a nuthatch. (Lat., *varius*, variegated.)

716. PROTONOTARIA Baird (Lat., *protonotarius*, chief notary; yellow head resembles prothonotary's hood)

1162. **P. citrea** (Boddaert). PROTHONOTARY WARBLER. Head, neck, and lower parts brilliant yellow; back olivaceous; wings and tail dusky; rump ashy; bill long; L. 5½. W. 3. T. 2¼. Southeast. N. Am., N. to N. B. (casually) and Minn.; S. to Venezuela; in bushy swamps; rather rare. A most beautiful bird. (Lat., *citreus*, pertaining to the citrus tree, i.e., lemon-color.)

717. LIMNOTHLYPIS Stone (Gr., *λίμνη*, marsh; *θλυπίς*, name of some finch)

1163. **L. swainsonii** (Audubon). SWAINSON'S WARBLER. Chiefly olive brown, rufescent on top of head; a brownish white superciliary stripe; soiled yellowish white below. L. 6. W. 2. T. 2. Southeast. U. S., N. to Neb. and Va.; S. to Jamaica; rare. (To William Swainson.)

718. HELMITHEROS Rafinesque (Gr., *ἕλμινς*, worm; *θηράω*, I hunt)

1164. **H. vermivorus** (Gmelin). WORM-EATING WARBLER. Olive green above, buffy and whitish below; head buffy, with 4 black stripes. L. 5½. W. 3. T. 2⅓. E. N. Am., N. to Ont., S. to Panama. (Lat., *vermivorus: vermis*, worm; *voro*, I devour.)

719. VERMIVORA Swainson (*Helminthophaga* Cabanis) (Lat., *vermivorus*, worm-eating)

a. Tail feathers with distinct white blotches; wings with bands or patches of white or yellow.
b. Throat and ear coverts black in ♂, dusky gray in ♀.

1165. **V. chrysoptera**[1] (Linnaeus). GOLDEN-WINGED WARBLER. Ashy blue; forehead, crown, and wing patch bright yellow; throat and broad stripe

[1] Certain hybrids of this and related species have been recorded, as follows:
V. lawrencei (Herrick). Similar to *V. chrysoptera;* cheeks and lower parts pure yellow; wing bars white or yellowish, back, etc., olive green. N. E. U. S., rare. A hybrid of *V. chrysoptera* and *V. pinus*. (To George N. Lawrence.)
V. leucobronchialis (Brewster). Ashy gray; throat and lower parts white; wing bands yellow or white; variable. E. U. S., not common. Now considered the white-breasted phase of *V. pinus*. (Gr., *λευκός*, white; *βρόγχος*, throat.)
V. cincinnatiensis (Langdon). Olive green, lores and part of ear coverts black; spots below eye and entire lower parts yellow. Cincinnati. Now regarded as a hybrid of *V. pinus* and *Oporornis formosus*. (See Ridgway, *Man. N. Am. Birds*, p. 487.) (To city of Cincinnati.)

through eye black; a white streak above eye and one below black of cheek; belly mostly white; ♀ duller. L. 5. W. 2½. T. 2¼. East. U. S., N. to S. Ont.; S. to Colombia; a beautiful bird. (Gr., χρυσόπτερος, golden-winged.)

1166. **V. bachmanii** (Audubon). BACHMAN'S WARBLER. Throat and band across crown black in ♂; forehead, chin, and lesser wing coverts yellow; general color greenish yellow; Southeast. U. S., N. to Mo. and Va., S. to Cuba; rare. (To John Bachman.)

bb. Throat yellow; ear coverts olive or ashy above, pale below.

1167. **V. pinus** (Linnaeus). BLUE-WINGED WARBLER. Olive green; crown and all under parts bright yellow; wing bars whitish; loral stripe black; ♀ similar, duller. L. 4½. W. 2⅓. T. 2. East. U. S., N. to S. Ontario; S. to Colombia. A handsome bird, like a miniature *Protonotaria*. (Lat., *pinus*, pine.)

aa. Tail feathers without white; no wing bars.

1168. **V. peregrina** (Wilson). TENNESSEE WARBLER. Olive green; head more or less ashy and without crown patch; white or slightly yellowish below. L. 4½. W. 2¾. T. 1¾. N. Am., S. to Venezuela; closely resembles the young of the two following, but its wings are nearly half longer than the short tail; *celata* has no ash color on head, and *ruficapilla* is yellower below. (Lat., *peregrinus*, wandering.)

1169. **V. celata** (Say). ORANGE-CROWNED WARBLER. Olive green, never ashy on head; crown patch orange brown, more or less concealed; dull pale yellow or pale greenish yellow below; ♀ duller, sometimes without crown patch. Known from the next by the more olive color of the head, which is similar to the back; belly less yellow. L. 4¾. W. 2¼. T. 2. Cent. and north. N. Am., S. to south. Mex.; rare in E. U. S. (Lat., *celatus*, concealed.)

1170. **V. ruficapilla** (Wilson). NASHVILLE WARBLER. Olive green, ash color on head and neck, the color contrasting with back; crown patch bright chestnut, more or less concealed; bright yellow below; lores and orbital ring pale; ♀ duller, crown patch obscure. L. 4⅔. W. 2½. T. 2. E. N. Am., S. to Guatemala. (Lat., *ruficapillus: rufus*, reddish; *capillus*, hair; i.e., crown.)

720. COMPSOTHLYPIS Cabanis

(*Parula* Bonaparte, regarded as preoccupied)
(Gr., κομψός, elegant; θλυπίς, name of some finch)

1171. **C. americana** (Linnaeus). PARULA WARBLER. Clear ashy blue; back with a large golden green patch; yellow below, belly white; a brown band across breast; white wing bars; tail feathers with white; ♀ obscurely marked. L. 4¾. W. 2⅓. T. 2. Southeast. U. S., N. to Md., and S. to West Indies; common. Very elegant. (Lat., *americanus*, American.) The form

from N. E. N. Am., larger and more richly colored, is C. **a. pusilla** (Wilson). (Lat., *pusillus*, very little.)

721. DENDROICA Gray (Gr., δένδρον, tree; οἰκέω, I inhabit)

A large genus comprising about 30 species of brightly colored little birds, very abundant in the United States during the migrations. The adult males of the different species are readily distinguished, but ♀ and young offer difficulties. The tail feathers are always marked with white or yellow, and the bill is usually little pointed, notched, and with evident bristles at the rictus.

The following artificial analysis, partly taken from Coues's "Key," will generally enable the student to distinguish specimens, at least the males in full plumage:

a. Tail feathers edged with yellow; plumage chiefly yellow. . . . . *aestiva*, 1173.
aa. Tail feathers blotched with white.
b. A white blotch on the primaries near their bases; no wing bars. . . *caerulescens*, 1174.
bb. No white blotch on primaries.
c. Wing bars, if present, not white.
d. White below; crown and wing patch more or less yellow. . . *pensylvanica*, 1178.
dd. Yellow below; sides reddish-streaked; crown chestnut. . . . *palmarum*, 1187.
ddd. Yellow below; sides black-streaked.
e. Back olive with reddish spots. . . . . *discolor*, 1186.
ee. Back ashy. . . . . *kirtlandii*, 1185.
cc. Wing bars or wing patch white.
f. Rump yellow.
g. Crown clear ash; yellow and streaked below. . . . . *magnolia*, 1176.
gg. Crown with yellow spot; white and streaked below. . . . . *coronata*, 1175.
ggg. Crown black with a median stripe of orange brown; an orange-brown ear spot. *tigrina*, 1172.
ff. Rump not yellow.
h. Crown with orange or yellow spot; throat orange or yellow. . . *fusca*, 1182.
hh. Crown black; no distinct yellow anywhere; much streaked. . . *striata*, 1180.
hhh. Crown blue or greenish, like the back; no definite yellow. . . *cerulea*, 1177.
hhhh. Crown chestnut, like the throat; no definite yellow; buffy below. *castanea*, 1179.
hhhhh. Crown bluish or yellowish, not as above, — some yellow.
i. Throat black (sometimes obscured by yellow tips to feathers); outer tail feather white-edged. . . . . *virens*, 1183.
ii. Throat yellow.
j. Back bluish gray; cheeks black. . . . . *dominica*, 1181.
jj. Back yellowish olive; cheeks same. . . . . *pinus*, 1184.

We copy from Coues's "Key" the following valuable diagnostic marks of Warblers in any plumage:

A white spot at base of primaries. . . . . *caerulescens*, 1174.
Wings and tail dusky, edged with yellow. . . . . *aestiva*, 1173.
Wing bars and belly yellow. . . . . *discolor*, 1186.
Wing bars yellow and belly pure white. . . . . *pensylvanica*, 1178.
Wing bars white and tail spots oblique, at end of 2 (rarely 3) outer feathers only. *pinus*, 1184.
Wing bars brownish; tail spots square, at end of 2 outer feathers only. . *palmarum*, 1187.
Wing bars not conspicuous; whole under parts yellow; back with no greenish. *kirtlandii*, 1185.
Tail spots at end of nearly all the feathers, and no definite yellow anywhere. . *cerulea*, 1177.

Tail spots at middle of nearly all the feathers; rump and belly yellow. . . *magnolia*, 1176.
Rump, sides of breast (usually), and crown with yellow; throat white. . . *coronata*, 1175.
Throat definitely yellow; belly white; back with no greenish. . . . . *dominica*, 1181.
Throat yellow or orange; crown with at least a trace of a central yellow or orange spot, and outer tail feather white-edged externally. . . . . *fusca*, 1182.
Throat, breast, and sides black or with black traces (seen on parting the feathers); sides of head with diffuse yellow; outer tail feather white-edged externally. . . . . *virens*, 1183.
Bill acute, perceptibly curved; rump usually yellow. . . . . *tigrina*, 1172.
With none of the foregoing special marks; crissum buffy. . . . . *castanea*, 1179.
Crissum white. . . . . *striata*, 1180.

a. Bill very acute, the tip appreciably decurved, terminal half of tongue with its edges folded over upon the upper surface, the tip deeply cleft and fringed. (*Perissoglossa*[1] Baird.)

1172. **D. tigrina** (Gmelin). Cape May Warbler. Olivaceous above, with black streaks; rump and sides of neck bright yellow; yellow below, much streaked with black; crown mostly black; ear coverts orange brown; a white wing patch; ♀ duller, with no black or reddish about head. L. 5¼. W. 2¾. T. 2. Cent. and east. N. Am., S. to West Indies. A fine species with a peculiar structure of the tongue, which is somewhat as in the Honey Creepers (*Caerebidae*) of the Tropics. (Lat., *tigrinus*, striped like a tiger.)

aa. Bill not very acute nor distinctly decurved at tip; tongue gradually tapering to the slightly cleft and fringed tip. (*Dendroica*.)
b. Tail feathers without white, the inner web yellow.

1173. **D. aestiva** (Gmelin). Yellow Warbler. Summer Warbler. Olive green above, golden yellow below; breast and sides with orange-brown streaks; quills dusky, edged with yellow; ♀ similar, the brown streaks often nearly obsolete. L. 5¼. W. 2½. T. 2¼. E. and cent. N. Am., S. to Brazil; common. There are several other subspecies in W. N. Am. (Lat., *aestivus*, pertaining to summer.)

bb. Tail feathers blotched with white.
c. A white spot on some of the primary quills, near their bases.

1174. **D. caerulescens** (Gmelin). Black-throated Blue Warbler. Rich gray blue, with a few black streaks on back; throat, sides of head, neck, and sides of body black, otherwise pure white below; quills black, edged with blue; ♀ dull olive greenish, obscurely marked, known by the white blotch on the primaries. L. 5½. W. 2¾. T. 2¼. E. N. Am., N. to S. E. Canada; and S. to Colombia; an elegant species; common. (Lat., *caerulescens*, bluish.) The breeding bird of the Allegheny Mts., from Md. to Ga., **D. c. cairnsi** Coues, is in ♂ duller, less blackish above.

cc. No white spot on primary quills.

1175. **D. coronata** (Linnaeus). Myrtle Warbler. Yellow-rumped Warbler. Bluish ash above, streaked with black; white below with large

[1] *Perissoglossa* is not accepted as a distinct genus, because similar traits in a degree are said to occur in other species of *Dendroica*.

black area on breast; crown patch, rump, and sides of breast bright yellow, there being 4 definite yellow places; ♀ and young brownish, with less yellow on breast and head. L. 5¾. W. 3. T. 2½. N. Am., S. to Panama; very abundant. The earliest migrant. Represented W. of Rocky Mts. (accidental E. to Mass.) by **D. c. auduboni** (Townsend), very similar but with the throat yellow. (Lat., *coronatus*, crowned.)

1176. **D. magnolia** (Wilson). MAGNOLIA WARBLER. BLACK-AND-YELLOW WARBLER. Back black, with olive skirtings; rump yellow; head clear ash; a white stripe behind eye; sides of head black; under parts rich yellow, with black streaks which are confluent on breast; crissum white; ♀ similar, more olivaceous, with much less black. L. 5. W. 2½. T. 2¼. East. and cent. N. Am., S. to Panama. A brilliant little bird. (*D. maculosa* Gmelin.) (Lat., *magnolia*, a genus of plants.)

1177. **D. cerulea** (Wilson) CERULEAN WARBLER. Grayish blue with black streaks; white below; breast and sides with streaks of slaty blue; ♀ not streaked, greenish above, slightly yellowish below. L. 4¼. W. 2¼. T. 2. E. N. Am., N. to S. E. Canada, and S. to Peru; not common E. A dainty species. (*D. rara* Wilson.) (Lat., *caeruleus*, blue.)

1178. **D. pensylvanica** (Linnaeus). CHESTNUT-SIDED WARBLER. Blackish above, much streaked with whitish and olive; crown clear yellow; black patch about eye; pure white below; a line of bright chestnut streaks along sides; wing patch yellowish (never clear white); ♀ similar but with less chestnut and black. L. 5. W. 2½. T. 2¼. E. N. Am., N. to S. E. Canada, and S. to Panama; common. A very pretty little bird. (Lat., *pensylvanicus*, of Pennsylvania.)

1179. **D. castanea** (Wilson). BAY-BREASTED WARBLER. AUTUMN WARBLER. Back ashy olive, streaked with black; forehead and sides of head black, enclosing a large deep chestnut crown patch; chin, throat, and sides chestnut, otherwise pale buffy below; ♀ more olivaceous with less chestnut; young scarcely distinguishable from *striata*, but the latter has crissum white instead of buffy; *castanea* is less streaked on sides. L. 5. W. 3. T. 2½. Cent. and east. N. Am., and S. to Colombia; not rare. (Lat., *castanea*, a chestnut.)

1180. **D. striata** (Forster). BLACKPOLL WARBLER. Ashy olive, white below; almost everywhere streaked with black, the streaks below narrow; whole top of head pure black; ♀ more olivaceous, slightly yellowish below; rather large. L. 5¾. W. 3. T. 2¼. N. Am. and S. to Chile; the last to migrate in spring, "bringing up the rear of the warbler hosts; when the Blackpolls appear in force, the collecting season is about over." (*Coues.*) (Lat., *striatus*, striped.)

1181. **D. dominica** (Linnaeus). YELLOW-THROATED WARBLER. Ashy gray; throat bright yellow; belly white; cheeks and top of head black; superciliary line white or yellowish in front. L. 5. W. 2¾. T. 2⅓. Southeast. U. S., N. to Mass., and S. to West Indies. A neat, plain species with the habits of a

creeper. (Lat., *dominicus*, of Santo Domingo.) Represented in middle W. by **D. d. albilora** Ridgway, smaller, with shorter bill, the superciliary streak chiefly or entirely white, instead of yellowish as in **D. d. dominica**. E.-cent. U. S., E. to W. Va., and S. to Costa Rica. (Lat., *albilorus: albus*, white; *lorum*, the lore.)

1182. **D. fusca** (Müller). Blackburnian Warbler. Black above, with buffy streaks; crown patch, superciliary line, sides of neck, and the whole throat brilliant orange, becoming yellowish on the belly; ♀ similar, but olive and yellow instead of black and orange. L. 5½. W. 2¾. T. 2¼. E. N. Am., and S. to Peru; in migration, among the tree tops. The most brilliant species in the family of wood warblers. (*D. blackburniae* [Gmelin].) (Lat., *fuscus*, dusky.)

1183. **D. virens** (Gmelin). Black-throated Green Warbler. Clear yellow olive; rump ashy; sides of head rich yellow; whole throat and breast jet black, the color extending along the sides; otherwise whitish below; ♀ and winter birds with the black interrupted or veiled with yellowish. L. 5. W. 2½. T. 2¼. Cent. and east. N. Am., and S. to Panama. (*Eu.*, accid.) (Lat., *virens*, green.)

1184. **D. pinus** (Wilson). Pine Warbler. Yellow olive above; under parts and superciliary line dark yellow; no sharp markings anywhere; wing bands dull whitish, distinct only in adult ♂; ♀ duller, or more grayish. L. 5¾. W. 3. T. 2⅓. E. N. Am., S. to Fla. and Tamaulipas, northeast. Mex.; in pine forests. The dullest in color of our species. (Lat., *pinus*, pine.) (*D. vigorsii* [Audubon].)

1185. **D. kirtlandii** (Baird). Kirtland's Warbler. Ashy blue above, back and sides streaked with black; yellow below; chin and crissum white; no distinct white wing bars; lores black; ♀ similar, duller. L. 5½. W. 2¾. T. 2⅜. E. U. S., and S. Ontario, S. to Bahama Is; rare. (To Dr. Jared P. Kirtland.)

1186. **D. discolor** (Vieillot). Prairie Warbler. Olive yellow above; back with a patch of red spots; forehead, superciliary line, wing bars, and under parts bright yellow; streaked below; sides of head with black; ♀ similar. L. 4¾. W. 2¼. T. 2. E. U. S., N. to S. Ontario and N. H., and S. to West Indies; chiefly in thickets. An elegant species. (Lat., *discolor*, of different colors.)

1187. **D. palmarum** (Gmelin). Palm Warbler. Redpoll Warbler. Brownish olive above, somewhat streaked, rump brighter; crown bright chestnut; superciliary line and under parts yellow, the latter with brown streaks; no wing bars; ♀ similar. L. 5. W. 2⅜. T. 2¼. Cent. and east. N. Am., S. to Yucatan; accid. W. to Cal.; abundant; terrestrial. (Lat., *palmarum*, of palms.) Represented along the Atlantic slope largely by **D. p. hypochrysea** Ridgway; larger, and much more deeply colored, entire lower parts bright yellow. (Gr., *ὑπό*, beneath; *χρύσεος*, golden.)

722. SEIURUS Swainson (Gr., *σείω*, I wave; *οὐρά*, tail)

a. Crown orange brown with a black stripe on each side.

1188. **S. aurocapillus** (Linnaeus). OVENBIRD. GOLDEN-CROWNED "THRUSH." Bright olive green, white below, sharply spotted on breast and streaked on sides, like a thrush. L. 6¼. W. 3. T. 2½. Cent. and east. N. A., and S. to Colombia, abundant in woodlands, spending most of its time on the ground, like the other species of this genus and those of the next. Remarkable for its ringing song and its curious oven-shaped nest. (Lat., *aurocapillus: aurum*, gold; *capillus*, hair.)

aa. Crown plain brownish.

1189. **S. noveboracensis** (Gmelin). WATER THRUSH. WATER WAGTAIL. Dark olive brown above, pale yellowish beneath; thickly streaked everywhere with the color of the back; superciliary line buffy; bill about half inch long; feet dark. L. 6. W. 3. T. 2⅓. E. N. Am., and S. to Brit. Guiana; in thickets; moves its tail like a Wagtail. (Lat., *noveboracensis*, of New York.) The western form, **S. n. notabilis** Ridgway, is larger and darker; it ranges E. to Minn. (casually to N. J.) and S. to northern S. Am. (Lat., *notabilis*, noteworthy.)

1190. **S. motacilla** (Vieillot). LOUISIANA WATER THRUSH. Color of preceding, but paler and buffy below, the streaks below broader and less sharply defined; superciliary stripe white or buffy; bill larger, about ¾ inch; feet pale. L. 6¼. W. 3¼. T. 2⅓. E. U. S., N. to Me. and S. Ontario; and S. to Colombia. (Lat., *motacilla*, wagtail.)

Next to *Icteria*, the species of *Seiurus* are the largest of our warblers.

723. OPORORNIS Baird (Gr., *ὀπώρα*, autumn; *ὄρνις*, bird)

1191. **O. formosus** (Wilson). KENTUCKY WARBLER. Clear olive green, bright yellow below; crown and sides of head and neck black, with a rich yellow superciliary stripe, which bends around the eye behind; ♀ with the black replaced by dusky olive. Tail short, more than half hidden by the coverts. L. 5¾. W. 3. T. 2¼. East. U. S., N. to Wisc. and N. H., and S. to Colombia; in low thickets. A handsome and active species. (Lat., *formosus*, comely.)

1192. **O. agilis** (Wilson). CONNECTICUT WARBLER. Olive green, ashy on head; throat and breast brownish ash, otherwise yellow below; no sharp markings; in fall almost uniform olivaceous above. L. 5¾. W. 3. T. 2¼. E. N. Am., N. to S. Canada; and S. to Colombia. A shy, quiet bird, rarely seen in spring. (Lat., *agilis*, agile.)

1193. **O. philadelphia** (Wilson). MOURNING WARBLER. Bright olive, clear yellow below; head ashy; throat and breast black, the feathers usually

ashy-skirted (as though the bird wore crape, hence "Mourning Warbler"); ♀ and ♂ not in full plumage ashy anteriorly, almost exactly like *O. agilis*, but the tail more nearly length of wings; no white spot on eyelid. L. 5½. W. 2⅓. T. 2⅛. E. N. Am., N. to S. Canada; S. to Ecuador; rather rare, in dense thickets. (Lat., *philadelphia*, [the City of] Philadelphia.)

724. GEOTHLYPIS Cabanis (Gr., γῆ, earth; θλυπίς, name of some finch)

1194. **G. trichas** (Linnaeus). Maryland Yellowthroat. Olive green; forehead and broad mask extending down sides of head and neck jet black, bordered behind with clear ash; under parts yellow, clear on throat and breast, whitish on abdomen; ♀ obscurely marked, without black mask and with less yellow. L. 4½. W. 2¼. T. 2⅓. E. U. S., from northern S. C. and Tex. to S. Pa., and S. to W. Indies; abundant in thickets. A pretty bird with a lively song. (Gr., τριχάς, thrush.) The northern race, **G. t. brachidactyla** (Swainson), is larger and more richly colored. Pa. to S. E. Canada; and S. to Cent. Am. (*brachidactylus:* Gr., βραχύς, short; δάκτυλος, digit.) Replaced W. by **G. t. occidentalis** Brewster, larger and brighter, the belly clear yellow instead of buffy whitish. Western edge of Great Plains and westward. (Lat., *occidentalis*, western.)

725. ICTERIA Vieillot (Gr., ἴκτερος, yellow)

1195. **I. virens** (Linnaeus). Yellow-breasted Chat. Olive green; throat and breast bright yellow; belly abruptly white; lores black; a white superciliary line; wings and tail plain; tarsus almost booted. L. 7⅓. W. 3¼. T. 3⅓. E. U. S., N. to Me. and S. Ontario, and S. to Costa Rica. A loud, quaint songster. Largest of our warblers. (Lat., *virens*, green.)

726. WILSONIA Bonaparte (To Alexander Wilson, "father of American ornithology")

a. Tail feathers blotched with white; no wing bars.

1196. **W. citrina** (Boddaert). Hooded Warbler. Bright yellow olive; breast, crown, and neck all around jet black, enclosing a broad golden mask; under parts from the breast bright yellow; ♀ olive instead of black. L. 5. W. 2¾. T. 2½. E. U. S., southerly, N. to Mass. and S. Ontario; and S. to Panama. A singular and beautiful species. (*W. mitrata* [Gmelin].) (Lat., *citrinus*, lemon color.)

aa. Tail feathers plain dusky; no wing bars.

1197. **W. pusilla** (Wilson). Wilson's Warbler. Clear yellow olive; crown glossy black; forehead, lores, sides of head, and entire under parts bright yellow; ♀ with less black. L. 4¾. W. 2½. T. 2¼. N. Am., chiefly N. and E., and S. to Cent. Am. (Lat., *pusillus*, very little.)

1198. **W. canadensis** (Linnaeus). Canadian Warbler. Bluish ash; crown streaked with black; under parts clear yellow; crissum white; lores black, continuous with black under the eye; this passing as a chain of black streaks down the side of the neck and encircling the breast like a necklace; a yellow superciliary streak; ♀ similar, with less black. L. 5⅓. W. 2¾. T. 2½. E. N. Am., W. to Colo., and S. to Peru. One of the handsomest warblers. (Lat., *canadensis*, Canadian.)

727. SETOPHAGA Swainson (Gr., *σής*, moth; *φάγος*, eater)

1199. **S. ruticilla** (Linnaeus). American Redstart. Black; sides of breast and large blotches on wings and tail orange-red; belly white, reddish tinged; no wing bars; ♀ olive, marked with creamy yellow instead of red. L. 5¼. W. 2½. T. 2½. N. Am., S. to Ecuador; abundant. A handsome and active warbler. (Lat., *ruticillus*, red-tailed.)

Family CCXXV. MOTACILLIDAE (The Wagtails)

Primaries 9, the first about as long as second; inner secondaries enlarged, the longest one about as long as the primaries in the closed wing. Bill shorter than the head, very slender, straight, acute, notched at tip. Feet large, fitted for walking; hind claw long, little curved, as in the larks; inner toe cleft; basal joint of outer toe united with middle one; tarsus as in Oscines generally, ending in a sharp, undivided ridge behind. Rictal bristles not conspicuous; nostrils exposed.

A group of about 100 species, mostly of the Old World. Terrestrial birds, with the habit (shared by various others) of moving the tail up and down, as if "balancing themselves on unsteady footing"; hence the name "Wagtail." (Lat., *motacilla*, wagtail.)

a. Tail shorter than wings, its feathers tapering; hind claw long and straightish. Anthus, 728.

728. ANTHUS Bechstein (Gr., *ἄνθος*, some small bird)

a. Tarsus longer than hind toe with claw. (*Anthus.*)

1200. **A. spinoletta rubescens** (Tunstall). American Pipit. Titlark. Dark brown above, slightly streaked; superciliary line and under parts buffy; breast and sides streaked; outer tail feathers with white. L. 6½. W. 3½, T. 3. N. Am., S. to Guatemala. (*A. pensilvanicus* [Latham].) (Ital., *spinoletta*, a pipit; *rubescens:* Lat., *rubescens*, reddish.)

aa. Tarsus shorter than hind toe with claw. (*Neocorys* Sclater.)

1201. **A. spragueii** (Audubon). Sprague's Pipit. Missouri Skylark. Buffy and dusky streaked. Interior plains of N. Am., from S. Manitoba to

S. Mexico, casually E. to S. C. Its habits are similar to those of the Skylark and its song is not inferior. (To Isaac Sprague.)

Family CCXXVI. MIMIDAE (The Mocking Birds)

Primaries 10, the 1st short, but not spurious; wings long; bill rather slender, notched, with bristles at the rictus; inner toe free to the base. Rather large, insectivorous birds, intermediate between the Wrens and the Thrushes. Colors plain. Species few, American. Preëminent as singers.

a. Bill shorter than middle toe without claw; bill notched at tip.
b. Tarsal scutellae distinct; (tail with white). . . . . Mimus, 729.
bb. Tarsal scutellae not distinct (tail without white). . . . . Dumetella, 730.
aa. Bill not shorter than middle toe with claw, often decurved; bill scarcely notched at tip. Toxostoma, 731.

729. MIMUS Boie (Lat., *mimus*, a mimic)

1202. **M. polyglottos** (Linnaeus). Mockingbird. Ashy gray above, nearly white below; wings blackish, with white wing bars; quills with a white patch; tail blackish, outer feathers white; ♀ with less white. L. 9½. W. 4½. T. 5. E. U. S., chiefly southerly; N. to S. E. Canada, S. to Bahama Is. A famous singer, easily first among birds in the range and variety of its notes. (Lat., *polyglottus:* from Gr., πολύς, many; γλῶττα, tongue.) A Western subspecies occupies the Western U. S.

730. DUMETELLA "S. D. W." (the name anonymous) (*Galeoscoptes* Cabanis) (diminutive of Lat., *dumetum*, thicket)

1203. **D. carolinensis** (Linnaeus). Catbird. Dark slate color; crown and tail black; crissum chestnut. L. 8¾. W. 3¾. T. 4. N. Am., very common E., N. to S. Canada, S. to Panama. (*Eu.*, accid.) A versatile singer. (Lat., *carolinensis*, Carolinian.)

731. TOXOSTOMA Wagler (Gr., τόξον, bow; στόμα, mouth)

a. Tarsus longer than bill, which is not greatly decurved; lower parts spotted and streaked.

1204. **T. rufa** (Linnaeus). Brown Thrasher. Brown "Thrush." Cinnamon red above; lower parts thickly spotted; bill nearly straight. W. 4. L. 11. T. 5¼. B. 1. E. U. S., abundant, and N. to S. E. Canada. (*Eu.*, accid.) A brilliant songster, its notes similar to those of the mockingbird, but softer and less varied. (Lat., *rufus*, reddish.)

Family CCXXVII. TROGLODYTIDAE (The Wrens)

Primaries 10, the first short, hardly spurious; wings moderate or short. Bill usually more or less slender, with or without a notch near the tip; nostrils

with a small scale, not covered by bristles. Tarsus scutellate, the plates usually distinct.

The wrens " are sprightly, fearless, and impudent little creatures, apt to show bad temper when they fancy themselves aggrieved by cats or people, or anything else that is big or unpleasant; they quarrel a good deal, and are particularly spiteful towards martins and swallows, whose homes they often invade and occupy. Their song is bright and hearty, and they are fond of their own music; when disturbed at it they make a great ado with noisy scolding. Part of them (*Cistothorus*) live in reedy swamps and marshes, where they hang astonishingly big globular nests, with a little hole on one side, on tufts of rushes, and lay 6 or 8 dark-colored eggs; the others nest anywhere." (*Coues.*) All of the wrens are plainly colored, being chiefly brown. All are insectivorous, and most of them migratory. Species numerous, most abundant in tropical America.

a. Outer tail feathers reaching decidedly beyond tips of longest lower coverts; (back without lengthwise streaks).
b. Bill rather stout, somewhat decurved at tip (upland wrens); (back without cross bars; superciliary streak distinct).
c. Tail not longer than wings. . . . . THRYOTHORUS, 732.
cc. Tail longer than wings. . . . . THRYOMANES, 733.
bb. Bill more slender, straight or slightly decurved (back with more or less distinct cross bars).
d. Tail long, more than ⅔ wing. . . . . TROGLODYTES, 734.
dd. Tail very short, less than ¼ wing. . . . . NANNUS, 735.
aa. Outer tail feathers, reaching little beyond tips of lower coverts; (back streaked lengthwise). (Marsh Wrens.)
e. Bill about half as long as head; (no white superciliary line). . CISTOTHORUS, 736.
ee. Bill slender, about as long as head; (a conspicuous white line above eye). TELMATODYTES, 737.

732. THRYOTHORUS Vieillot (Gr., *θρύον*, reed; *θορέω*, I leap)

1205. **T. ludovicianus** (Latham). CAROLINA WREN. Clear reddish brown, brightest on rump; pale buffy below; wings barred with dusky; a pale superciliary stripe. L. 6. W. 2¼. T. 2⅓. East. U. S., southerly, N. to Wisc. and Me. W. to Iowa and Illinois. A remarkable singer. (Lat., *ludovicianus*, Louisianian.)

733. THRYOMANES Sclater (Gr., *θρύον*, reed; *μαίνομαι*, I love greatly)

1206. **T. bewickii** (Audubon). BEWICK'S WREN. Dark grayish brown above; brownish white below; white streak above eye and to neck. L. 5½. W. 2¼. T. 2½. E. U. S., N. to Pa. and Mich. and casually to Ontario and Me.; winters S. to Gulf Coast. (To Thomas Bewick, author of *British Birds.*)

734. TROGLODYTES Vieillot (Gr., *τρωγλοδύτης*, a cave dweller)

1207. **T. aedon** Vieillot. HOUSE WREN. Brown, brightest behind; brownish or whitish below; everywhere above and behind barred or waved with

darker, distinctly so on wings, tail, and crissum. L. 5. W. 2. T. 2. E. U. S., and N. to S. E. Canada, S. to Tamaulipas, Mex.; abundant. An active and familar little bird. (Gr., *ἀηδών*, the nightingale.)

735. NANNUS Billberg (Gr., *νάννος*, a dwarf)

1208. **N. troglodytes hiemalis** (Vieillot). Winter Wren. Deep reddish brown, waved with dusky; wings, tail, and belly posteriorly sharply barred. L. 4. W. 1⅔. T. 1¼. Cent. and E. N. Am., S. to Tex. and Fla. A fine singer. (Gr., *τρωγλοδύτης*, a cave dweller; Lat., *hiemalis*, pertaining to winter.)

736. CISTOTHORUS Cabanis (Gr., *κίστος*, a shrub; *θορέω*, I leap)

1209. **C. stellaris** (Naumaun). Short-billed Marsh Wren. Dark brown, head and back darker; entire upper parts with white streaks; lower parts buffy. L. 4½. W. 1¾. Cent. and east. N. Am., from S. E. Canada to Fla.; in marshes; rather rare. (Lat., *stellaris*, starry.)

737. TELMATODYTES Cabanis (Gr., *τέλμα*, swamp; *δύτης*, diver; i.e., an inhabitant)

1210. **T. palustris** (Wilson). Long-billed Marsh Wren. Clear brown; back with a black patch containing white streaks; otherwise unstreaked above; crown blackish; lower parts brownish white. L. 5. W. 2. T. 1¾. Coast of E. U. S., from Mass. to N. C.; abundant in reedy swamps. (Lat., *palustris*, pertaining to a marsh.) Subsp. **T. p. iliacus** Ridgway, is paler. E. U. S. and S. E. Canada, W. to Great Plains. (Lat., *iliacus*, relating to the flank.)

Family CCXXVIII. CERTHIIDAE (The Creepers)

Primaries 10, first less than half second. Bill slender, as long as head, without notch or bristles. Tarsus scutellate, shorter than middle toe. Claws all very long, curved and compressed. Wings about as long as tail; tail feathers pointed, with stiffened shafts, somewhat like the tail of a woodpecker, and similarly used for support. Species few, widely distributed. Habits similar to those of the Nuthatches, but the voice different, being small and fine. (The above diagnosis applies chiefly to the subfamily *Certhiinae*.)

a. Bill decurved, about as long as head. . . . . Certhia, 738.

738. CERTHIA Linnaeus (Gr., *κέρθιος*, the tree creeper)

1211. **C. familiaris americana** (Bonaparte). Brown Creeper. Plumage dark brown, above much barred and streaked with whitish; pale below; rump

clear tawny. L. 5½. W. 2¾. T. 2¾. E. N. Am., N. to S. E. Canada. A curious little bird. (Lat., *familiaris*, domestic; *americanus*, American.)

Family CCXXIX. SITTIDAE (The Nuthatches)

Primaries 10, the first short. Bill slender, as long as head, not notched nor decurved; loral feathers bristly; nostrils concealed by dense tufts. Tarsus scutellate; bill slender, as long as head; hind toe longer than middle toe; tail much shorter than wing; plumage more or less lax, subject to few variations. Small birds, apparently allied to the titmice on the one hand and to the wrens on the other. Species not numerous, in forests, widely distributed over the world; insectivorous and mostly not migratory.

739. SITTA Linnaeus (Gr., σίττη, the nuthatch)

1212. **S. carolinensis cookei** Oberholser. White-breasted Nuthatch. Bluish gray above, white below; crissum with rusty brown; crown and nape black, unstriped; middle tail feathers like the back, others black, blotched with white; ♀ with less black on the head. L. 5½. W. 3½. T. 2. N. E. U. S., and S. E. Canada, more or less common everywhere. An active, nimble little bird, running up and down tree trunks and limbs, and hanging in every conceivable attitude, the head down as often as up. (Lat., *carolinensis*, Carolinian; *cookei*, to W. W. Cooke.)

1213. **S. canadensis** Linnaeus. Red-breasted Nuthatch. Bluish gray, brighter than the preceding, light or dark rusty brown below; crown glossy black (♂), or bluish (♀), bordered by white and black stripes. L. 4½. W. 2⅜. T. 1½. N. Am., S. to Gulf Coast and Lower Cal. (Lat., *canadensis*, Canadian.)

1214. **S. pusilla** Latham. Brown-headed Nuthatch. Bluish gray; crown clear brown, a whitish spot on nape; dull whitish below. L. 4. W. 2½. T. 1⅓. Southeast. U. S., casually N. to Mich. and N. Y., and S. to Bahamas. (Lat., *pusillus*, very little.)

Family CCXXX. PARIDAE (The Titmice)

The Titmice, like the Nuthatches, are small tree-loving birds, having 10 primaries, the 1st rather short. Bill stoutish, not notched nor decurved, much shorter than head; loral feathers bristly; nostrils concealed by bristly tufts; hind toe shorter than middle toe; tail as long as wing. Plumage lax; mostly plainly colored, without much variation of age or sex. Species numerous, in woodlands, insectivorous and rarely migratory, some of them of very small size. (Lat., *parus*, a titmouse.)

a. Head conspicuously crested. . . . . Baeolophus, 740.
aa. Head not crested. . . . . Penthestes, 741.

740. BAEOLOPHUS Cabanis (*Lophophanes* Kaup, part, for American species) (Gr., *βαιός*, small; *λόφος*, crest)

1215. **B. bicolor** (Linnaeus). TUFTED TITMOUSE. Grayish ashy, the forehead alone black; whitish below; sides washed with reddish. L. 6¼. W. 3¼. T. 3¼. E. U. S., southerly, N. to Mich.; common in woodlands. Remarkable for its loud, cheerful whistle. (Lat., *bicolor*, two-colored.)

741. PENTHESTES Reichenbach (Gr., *πενθέω*, I mourn; *ἐδεστής*, eater)

1216. **P. atricapillus** (Linnaeus). CHICKADEE. BLACK-CAPPED CHICKADEE. Grayish ash; wings and tail plain, with whitish edging; crown, nape, chin, and throat black; cheeks white; no white superciliary line. L. 5. W. 2½. T. 2½. N. Am., S. to Mo. and N. C.; abundant. (Lat., *atricapillus: ater*, black; *capillus*, hair.) Represented in cent. and northwest. N. Am., E. to Iowa and Minn., by **P. a. septentrionalis** (Harris); paler, with tail (2¾), longer than wings. (Lat., *septentrionalis*, northern.)

1217. **P. carolinensis** (Audubon). CAROLINA CHICKADEE. Similar to the preceding; tertials and greater wing coverts without whitish edgings; smaller; tail shorter. L. 4½. W. 2½. T. 2½. Southeastern U. S., N. to cent. N. J. and Ind. (Lat., *carolinensis*, Carolinian.)

1218. **P. hudsonicus** (Forster). HUDSONIAN CHICKADEE. Olive brown; crown browner; some pale chestnut below; throat black; cheeks white. L. 5. W. 2⅓. T. 2⅔. Northern N. Am., S. to northern U. S. (Lat., *hudsonicus*, of Hudson [Bay].) Subsp. **P. h. littoralis** (Bryant), S. Labrador, S. to Conn., is smaller. (Lat., *litoralis*, belonging to the seashore.)

FAMILY CCXXXI. MUSCICAPIDAE (THE OLD WORLD FLYCATCHERS)

A large family of the Old World, with one representative within our limits. They have much in common with the *Sylviidae*, but like the wrens, they have the tarsus scutellate, as usual in less specialized types of birds. (Lat., *musca*, fly; *capio*, I take.)

742. POLIOPTILA Sclater (Gr., *πολιός*, hoary; *πτίλον*, feather)

1219. **P. caerulea** (Linnaeus). BLUE-GRAY GNAT-CATCHER. Clear bluish gray, brightest on head; whitish below; ♂ with forehead and superciliary line black; outer tail feathers chiefly white. L. 4⅓. W. 2. T. 2¼. Southeastern U. S., chiefly southerly; N. to Wisc. and New England. A sprightly little bird with a weak voice, but really a fine singer. (Lat., *caeruleus*, blue.)

FAMILY CCXXXII. SYLVIIDAE (THE OLD WORLD WARBLERS)

Diminutive Thrushes. Primaries 10, the first short. Bill slender, depressed at base, notched and decurved at tip. Rictus with bristles; nostrils oval.

Tarsus booted. Basal joint of middle toe attached its whole length externally, half way internally. A large family of nearly 500 species of small birds, chiefly of the Old World, where they fill the place taken in America by the *Compsothlypidae.* (Lat., *sylva,* forest.)

a. Nostril hidden by a single tiny feather. . . . . REGULUS, 743.
aa. Nostril with a tuft of small bristle-like feathers. . . . . CORTHYLIO, 744.

743. REGULUS Cuvier (Lat., dim. of *rex,* king — "King of the wrens")

1220. **R. regulus satrapa** Lichtenstein. GOLDEN-CROWNED KINGLET. Olivaceous; crown with a yellow patch, bordered with black, orange red in the center in ♂; forehead and line over eye whitish; two white wing bars. L. 4. W. 2½. T. 1¾. N. Am.; not rare. (Gr., *σατράπης,* a ruler.)

744. CORTHYLIO Cabanis (Gr., *κορθύλος,* a bird with a crest)

1221. **C. calendula** (Linnaeus). RUBY-CROWNED KINGLET. Olivaceous; crown with a scarlet patch in ♂, wanting in ♀; no black about head. L. 4¼. W. 2⅓. T. 1¾. N. Am., S. to Guatemala; common. (Ital., *calendula,* marigold, in allusion to the bird's crest.)

FAMILY CCXXXIII. TURDIDAE[1] (THE THRUSHES)

Primaries 10, the first short or spurious; bill generally rather long, not conical, usually with a slight notch near the tip; nostrils oval, not concealed; but nearly or quite reached by the bristly frontal feathers; rictus with bristles, which are well developed in most of our species; tarsus always "booted"; i.e., enveloped in a continuous plate, formed by the fusion of all the scutella except 2 or 3 of the lowest. Toes deeply cleft, the inner one free, the outer united to the middle one, not more than half the length of the first basal joint.

A large family of about 600 species, found in most parts of the world, and embracing a wide variety of forms. Nearly all of them are remarkable for their vocal powers. Their food consists of insects and fruits.

a. Bill short, depressed, notched, and slightly hooked at tip; gonys not more than ⅓ the commissure; tail about as long as wings. (*Myadestinae.*) . . . . . MYADESTES, 745.
aa. Bill not depressed nor hooked; gonys more than ⅓ the commissure. (*Turdinae.*)
b. Wings moderate; (no blue).
c. Tarsus longer than middle toe with claw; nostrils exposed; nasal fossae without feathers; bill notched near its tip; sexes similar.
d. Bill much widened at base; (breast spotted). . . . . HYLOCICHLA, 746.
dd. Bill little widened at base; (breast in adult unspotted). . . . TURDUS, 747.
cc. Tarsus not longer than middle toe with claw; nostrils partly concealed by feathers in the nasal fossae; bill not notched; sexes unlike. . . . . IXOREUS, 748.
bb. Wings long and pointed. (*Saxicolinae.*)
e. Plumage chiefly blue on upper surface. . . . . SIALIA, 749.

[1] One of the most remarkable of the thrush-like birds is the Water Ouzel or Dipper (*Cinclus mexicanus* Swainson), an aquatic thrush which swims (or rather flies) freely *under* water, although not web-footed. It is a fine singer, living about mountain torrents in the Rocky Mountain regions. Similar species occur in Europe, Asia, and South America. They are now placed in a separate family, *Cinclidae.*

745. **MYADESTES** Swainson (Gr., μυῖα, fly; ἐδεστής, eater)

1222. **M. townsendi** (Audubon). Townsend's Solitaire. Fly-catching Thrush. Ashy gray, paler below; wing bands buffy; tail blackish; whitish ring about eye; young with tawny spots. L. 8. W. 4½. T. 4½. Rocky Mountains and westward, N. to Alaska, S. to central Mex., straying E. to N. Y. A most exquisite songster. (To J. K. Townsend.)

746. **HYLOCICHLA** Baird (Gr., ὕλη, forest; κίχλη, thrush)

a. Wings never more than 3½ times tarsus; plain brownish above; spotted below.
b. Reddish color of back most distinct on head.

1223. **H. mustelina** (Gmelin). Wood Thrush. Cinnamon brown, brightest on the head, shading into olive on the rump; breast with large, very distinct dusky spots. L. 8. W. 4¼. T. 3. E. U. S., and N. to Ont., S. to Costa Rica, in woodland. Our largest and handsomest woodland thrush. An exquisite songster. (Lat., *mustelinus*, weasel-colored.)

bb. Reddish color of back equally distinct from head to tail.

1224. **H. fuscescens** (Stephens). Veery. Wilson's Thrush. Tawny Thrush. Uniform reddish brown above; breast and throat washed with brownish or pinkish buff, and marked with small indistinct brownish spots. L. 7½. W. 4¼. T. 3⅛. E. N. Am., N. to S. E. Canada, S. to Brazil; in damp woods. A fine songster, superior to the wood thrush in its range of notes. (Lat., *fuscescens*, becoming dusky.) The Western variety, Ind. to Great Basin, **H. f. salicicola** Ridgway, is russet olive, the cheeks paler, with broader markings below. (Lat., *salicicola: salix*, a willow; *incola*, inhabitant.)

bbb. Back entirely olive, with no reddish shade anywhere.
c. Sides of head without buffy shades.

1225. **H. minima** (Lafresnaye). Bicknell's Thrush. Very similar to *H. ustulata*, but without buffy or whitish ring about eye, or any buffy tint about head. N. E. U. S. and S. E. Canada, S. to Northern S. A. (Lat., *minimus*, smallest.) A larger form, with more greenish upper parts is **H. m. aliciae** (Baird), Gray-cheeked Thrush, from N. and E. N. A., S. to Peru. (Lat., *aliciae*, to Miss Alice Kennicott.)

cc. Sides of head more or less shaded with buffy.

1226. **H. ustulata swainsoni** (Tschudi). Olive-backed Thrush. Uniform olive above; breast and throat thickly marked with large, dusky olive spots; breast and sides of head strongly buffy-tinted; a conspicuous buffy orbital ring. L. 7. W. 4¼. T. 3. N. Am., S. to Argentina. (Lat., *ustulatus*, scorched; *swainsoni*, to William Swainson.)

bbbb. Reddish color of upper parts confined chiefly to the tail.

1227. **H. guttata faxoni** Bangs and Penard. HERMIT THRUSH. Olive brown above, becoming rufous on rump and tail; breast with numerous, rather distinct, dusky spots; a whitish orbital ring. L. 7. W. 3½. T. 2½. N. and E. N. Am., S. to Cuba. (*Eu.*, accid.) A sweet singer. (Lat., *guttatus*, spotted; *faxoni* to Walter Faxon.)

747. TURDUS Linnaeus (Lat., *turdus*, a thrush)

1228. **T. migratorius** Linnaeus. AMERICAN ROBIN. AMERICAN REDBREAST. Olive gray above; head and tail blackish; throat white, with black streaks; under parts chestnut brown. L. 9¾. W. 5½. T. 4½. N. and E. N. Am., S. to Cuba and N. E. Mex.; everywhere abundant. A familiar, easy-going bird. (Lat., *migratorius*, migratory.) The SOUTHERN ROBIN, **T. m. achrusterus** (Batchelder) is paler, duller, and smaller, and breeds in southeast. U. S., N. to Md. and S. Ill. (Gr., *ἄχροος*, pale; *πτερόν*, wing.)

748. IXOREUS Bonaparte (Gr., *ἰξός*, mistletoe berry)

1229. **I. naevius** (Gmelin). VARIED THRUSH. OREGON ROBIN. Slate color above, orange brown below; throat not streaked; with black collar. L. 9¾. W. 5. T. 4. Pacific slope and N. W. N. Am., rarely straying E. to Mass. A beautiful bird. (Lat., *naevius*, spotted.)

749. SIALIA Swainson (Gr., *σιαλίς*, name of some bird)

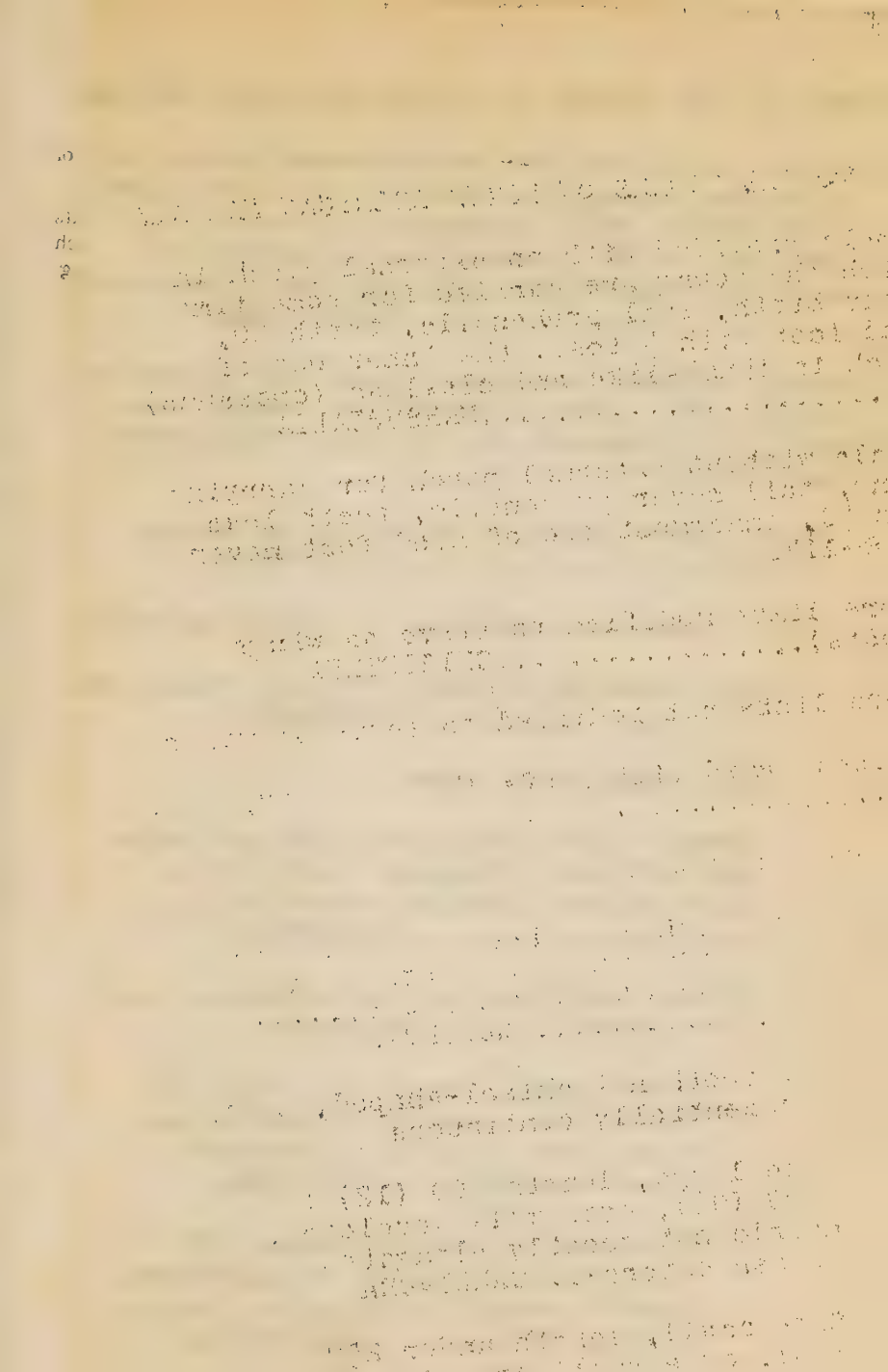
1230. **S. sialis** (Linnaeus). BLUEBIRD. Bright blue above, throat and breast reddish brown ("the sky on its back and the earth on its breast"); belly white; ♀ duller, with a brownish tinge on back; young, as in other bluebirds, spotted. L. 6¾. W. 4. E. 3. E. N. Am., N. to S. E. Canada, S. to Cuba (accid.), abundant; breeds everywhere. One of our most attractive and familiar birds, which welcomes spring with "its shivering bodiless notes." (Gr., *σιαλίς*, name of some bird.)

1231. **S. mexicana bairdi** Ridgway. CHESTNUT-BACKED BLUEBIRD. Head, neck all around, and upper parts generally, deep bright blue; back with more or less chestnut; breast and sides reddish brown, throat bluish; size of last. Rocky Mts. region, Colo. to central Mex.; common; rarely E. to Iowa. (Lat., *mexicanus*, Mexican; *bairdi*, to Spencer F. Baird.)

1232. **S. currucoides** (Bechstein). MOUNTAIN BLUEBIRD. Rich greenish blue; breast also blue; belly white; ♀ with pale drab instead of blue, on breast, etc.; rather larger than the others. W. N. Am., S. to northern Mex., E. to Kans. One of the prettiest of thrushes and one of the most attractive of our birds. (*S. arctica* Swainson.) (Lat., *Curruca*, a European group of *Sylviidae;* Gr., *εἶδος*, appearance.)

With this charming (but clumsily-named) bird we close the long series feathered *Sauropsida*.

The next class, the *Mammalia*, is widely different from the birds, but i lowest order, the *Monotremes*, laying large eggs with leathery shells, approac the common reptilian stock from which both mammals and birds have sprun



KEY TO THE ORDERS OF NORTH AMERICAN MAMMALS

Female provided with an external pouch in which the young are carried for some time after birth, tail prehensile, teeth 50, hind foot with 5 toes, the innermost of which is thumb-like and clawless (opossums) .....MARSUPIALIA P369

Female without external pouch for carrying young, tail never prehensile, teeth less than 50, innermost toe of hind foot never thumb-like

Fore limbs modified to serve as wings (bats).....CHIROPTERA P373

Fore limbs not modified to serve as wings

Toes armed with hoofs (bison, deer, etc.) ..... UNGULATA P397

Toes armed with claws

Front teeth chisel-shaped and separated from grinding teeth by a wide space (gnawing animals)..... ..... RODENTIA P385

Front teeth not chisel-shaped, tooth row essentially continuous

Size large, length 300 (12) to 2400 (96), eyes well developed, muzzle not greatly elongated (flesh eaters).. CARNIVORA P376

Size small, length under 250 (10), eyes small or rudimentary, muzzle greatly elongated (moles, shrews, etc.)... INSECTIVORA P369

Class I MAMMALIA (The Mammals)

A Mammal is a warm-blooded, air-breathing vertebrate, having the skin more or less hairy (or rarely naked); viviparous, the embryo developed from a minute egg almost destitute of food yolk (except in the Australian Subclass *Monotremata*, in which group the eggs are large, as in Reptiles, and are developed outside the body); the young nourished for a time after birth by milk, secreted in the mammary glands of the mother; respiration never by means of gills, but after birth by lungs, suspended freely in the thoracic cavity, which is completely separated from the abdominal cavity by a muscular septum (the diaphragm); heart with four cavities; a complete double circulation. Skeleton more firm than in other vertebrates, the bones containing a larger proportion of salts of lime. Skull articulating with the atlas by means of 2 occipital condyles; bones of face immovably joined by sutures; each half of lower jaw a single bone, articulating directly with the skull; the quadrate bone becoming one of the bones of the ear (the *malleus*). Brain case comparatively large, corresponding with the increased development of the brain. The numerous other peculiarities of the skeleton and the viscera need not be noticed in this connection.

Orders of Mammalia

a. Young developed within the uterus from a minute egg which is destitute of food yolk; milk glands with nipples; no cloaca. (Subclass *Eutheria*.)

b. Young born when of very small size and incomplete development, never connected by a placenta to the mother; brain small, its corpus callosum rudimentary. (Superorder *Didelphia*.) . . . . . Marsupialia, LVII.

bb. Young not born until of considerable size and nearly perfect development, deriving its nourishment, before birth, from the mother through the intervention of a placenta; a well-developed corpus callosum (Superorder *Monodelphia*.)

c. Brain with a relatively small cerebrum, which does not cover the other ganglia, much of the cerebellum being exposed behind, and in front much of the optic lobes.

d. Canine teeth none; incisors $\frac{2}{2}$, rarely $\frac{1}{2}$, chisel-shaped; limbs adapted for walking. Glires, LXI.

dd. Canine teeth present, in some form; incisors not $\frac{2}{2}$ nor $\frac{1}{2}$.

e. Anterior limbs not adapted for flight; ulna and radius not united; hand normal; mammae usually abdominal. . . . . Insectivora, LVIII.

ee. Anterior limbs adapted for flight; ulna and radius united; bones of hand and fingers much elongated, supporting a thin, leathery skin, extending along sides of body to the posterior limbs; mammae pectoral. . . Chiroptera, LIX.

cc. Brain with a relatively large cerebrum overlapping much, or all, of the cerebellum and optic lobes.

f. Posterior limbs absent, the pelvis rudimentary; anterior limbs reduced to broad flattened paddles, without distinct fingers or claws; no clavicles; tail with a broad, horizontally placed caudal fin; cervical vertebrae more or less grown together; carnivorous. . . . . Cetacea, LXIII.

ff. Posterior limbs and pelvis well developed; anterior limbs with hoofs, claws, or nails.

g. Femur and humerus not exserted beyond the common integuments of the body; clavicles more or less rudimentary; mammae abdominal or inguinal.

h. Feet with hoofs; molars mostly with grinding surfaces; incisors various; no tusks; developed toes, 1 to 4; herbivorous. . . . Artiodactyla, LXII.

hh. Feet with developed claws; canines specialized; molars, one or more, sectorial, adapted for cutting; incisors $\frac{3}{3}$; carnivorous. . . . . Carnivora, LX.

gg. Femur and humerus exserted; feet with distinct toes which are provided with nails; clavicles present; an inner digit of hand (thumb) opposable to some of the others; orbits encircled by bone and directed forwards; mammae pectoral, two in number (rarely also an inguinal pair). . . Primates, LXIV.

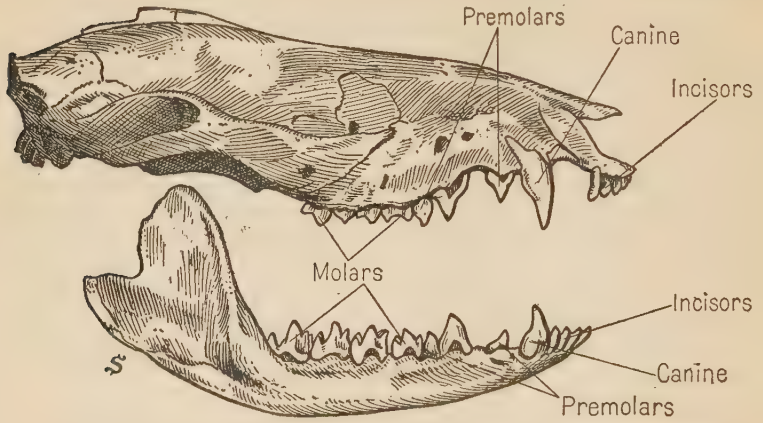


Fig. 8. Skull of an Opossum, showing the arrangement of teeth characteristic of the species in the order *Marsupialia*.

Order LVII. **MARSUPIALIA** (The Marsupials)

Young developed without a placenta, and born at a very early stage and incomplete condition of development. The young after birth are developed in an abdominal pouch formed by a fold of skin about the milk glands of the mother, where they remain for a considerable time. Reproductive organs in both sexes of peculiar structure, nearly all the parts being double in the female. Skeleton showing numerous peculiarities, the teeth usually more numerous than in the higher Mammals. Brain small, the corpus callosum rudimentary. Heart with two venae cavae. This large order is chiefly confined to Australia. It represents an early or primitive type of Mammalia, which is now extinct in most parts of the world. The single American group approaches most nearly to ordinary Mammals. (Lat., *marsupium*, pouch.)

Families of Marsupialia

a. Tail long, prehensile, nearly naked; feet plantigrade, 5-toed, the first toe thumb-like and without claw; teeth 50. . . . . Didelphidae, CCXXXIV.

Family CCXXXIV. **DIDELPHIDAE** (The Opossums)

Marsupial mammals of small size, with the teeth i. $\frac{5}{4}:\frac{5}{4}$, c. $\frac{1}{1}:\frac{1}{1}$, pm. $\frac{3}{3}:\frac{3}{3}$, m. $\frac{4}{4}:\frac{4}{4}$. Feet 5-toed, plantigrade, the claws 5–4. Tail usually very long, prehen-

sile, nearly naked, covered by a scaly skin, with a few scattered hairs. Genera 7, species about 24, all American and chiefly belonging to the tropics. The common Opossum is one of the largest of the group. All are sluggish animals, arboreal (*Didelphis*) or aquatic (*Chironectes*), becoming very fat. They feed on insects and various other small animals, and on eggs and fruit.

a. Arboreal; feet not webbed. . . . . DIDELPHIS, 750.

750. DIDELPHIS Linnaeus (Gr., *δίς*, two; *δελφύς*, womb)

1233. **D. virginiana** Kerr. COMMON OPOSSUM. Soiled yellowish, with some darker hairs; ears black, leathery; legs dark. L. 35. T. 15. N. Y. to S. Cal. and S.; common S., where its flesh is a valued luxury, much like that of a young pig. (Lat., of Virginia.)

ORDER LVIII. INSECTIVORA (THE INSECT EATERS)

Teeth of 4 kinds, molars, premolars, canines, and incisors, all with enamel; brain small, the cerebrum without Sylvian fissure; limbs well developed and adapted for walking.

A large group of small animals, analogous to the Carnivora in many respects, but the individuals so small as to be unable to attack vertebrate animals, and therefore feed chiefly on insects. But two of the numerous families are represented in our fauna.

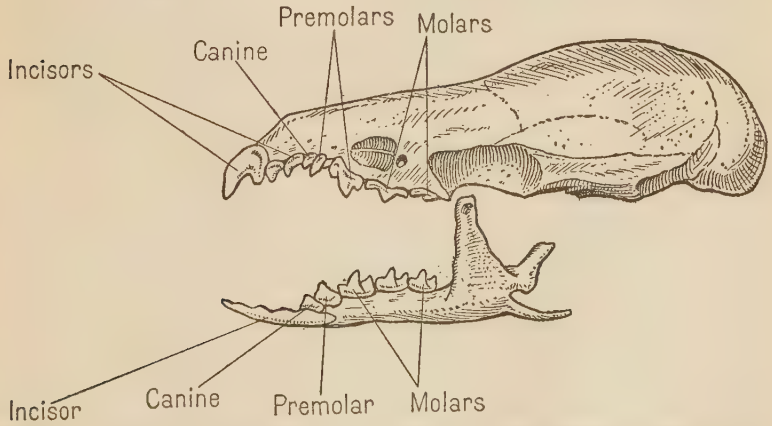


FIG. 9. Skull of a Shrew (*Neosorex*), showing the arrangement of teeth characteristic of the species in the order *Insectivora*.

a. Fur soft, without spines; sides of body without membrane for "flying," canine teeth indistinct.
b. Fore feet not enlarged; muzzle elongate; external ear developed; appearance mouse-like. SORICIDAE, CCXXXV.
bb. Fore feet very broad, with stout claws adapted for digging; no external ear, size larger. TALPIDAE, CCXXXVI.

FAMILY CCXXXV. SORICIDAE (THE SHREWS)

Small Insectivora, mouse-like in appearance, with the eyes and external ears developed. Muzzle elongate. Feet normal, not fitted for digging; the fore feet mostly smaller than the hind ones. Teeth $\frac{16 \text{ to } 20}{12}$; canines obsolete. The most abundant and widely distributed of the Insectivora, comprising more than half the known species, arranged in many genera.

a. Ears large, the concha turned backward; tail long, longer than head.
b. Hind feet moderate, not conspicuously fringed. . . . . SOREX, 751.
bb. Hind feet long and large, conspicuously fringed with stout bristles for swimming; toes fringed, 3d and 4th webbed at base. . . . . NEOSOREX, 752.
c. Canine without secondary cusp. L. $2\frac{3}{4}$ to $4\frac{1}{2}$.
cc. Canine with a secondary cusp; size very small. L. $2\frac{1}{2}$. . . . MICROSOREX, 753.
aa. Ears small, not visible externally, the concha directed forwards, so as to hide the opening; tail short, not longer than head.
d. Teeth 32; brown-tipped. . . . . BLARINA, 754.
dd. Teeth 32; body very small. . . . . CRYPTOTIS, 755.

751. SOREX Linnaeus (Gr., σωραξ, a shrew)

a. 3d upper unicuspid larger than 4th.

1234. **S. arcticus arcticus** Kerr. RICHARDSON'S SHREW. Back with a well-defined dark band; ears rather small; tail scant-haired. L. 4. T. $1\frac{1}{4}$. Nova Scotia, W. Ontario, Manitoba, and N. W. (Lat., arctic.) **S. a. laricorum** Jackson. Paler, and with flatter skull. N. Mich., N. Wisc., W. to east. N. D.

1235. **S. fumeus fumeus** (Miller). SMOKY SHREW. Back not noticeably darker than sides. L. $4\frac{3}{8}$. T. $1\frac{3}{4}$. Great Lakes, N. E., and S., along the Alleghenies, to Tenn. (Lat., smoky.) **S. f. umbrosus** Jackson occurs in Nova Scotia and Maine.

1236. **S. longirostris longirostris** Bachman. SOUTHERN SHREW. Brown; white below; tail bicolor. Very small. L. 3. T. 1. Swamps, east. S. C. to Ala., N. to Ill. and Md. **S. l. fisheri** Merriam. Larger. L. $4\frac{1}{3}$. T. $1\frac{2}{3}$. Dismal Swamp.

1237. **S. dispar** Batchelder. LONG-TAILED SHREW. Similar to *S. fumeus* in color and size, but readily distinguished by its long tail. L. $5\frac{1}{3}$. T. $2\frac{3}{8}$. Adirondacks and Catskills, N. Y. (Lat., unlike.)

1238. **S. gaspensis.** Anthony & Goodwin. Similar to *S. dispar*, but paler and grayer, and distinctly smaller. Gaspé Peninsula, Quebec. (Lat., from Gaspé.)

1239. **S. cinereus cinereus** Kerr. Common Shrew. Ears large; chestnut brown. Tail short, scant-haired. Size very small; L. $2\frac{3}{4}$. T. $1\frac{1}{2}$. N. U. S. and Canada, N. W. to Alaska, S. to S. N. J. and Ind., and along the Alleghenies to N. C. (Lat., gray.)

1240. **S. fontinalis** Hollister. Resembles *S. cinereus*, but much smaller. Potomac region.

bb. 3d upper unicuspid smaller than 4th.

752. NEOSOREX Baird (Gr., *νεός*, new; *σῦραξ*, shrew)

1241. **N. palustris palustris** (Richardson). Water Shrew. Hoary black; belly ashy gray; chin not pale, largest of our shrews. L. 6. T. $2\frac{1}{2}$. E. Ontario, N. E. Minn., and N. W., in swamps. (Lat., of the marsh.) **N. p. hydrobadistes** (Jackson). Smaller and darker in summer fur. N. Wisc. and Mich., W. to northeast. S. D. **N. p. albibarbis** (Cope). Belly dark, like the back or somewhat grayer; chin pale. L. 6. T. $2\frac{4}{5}$. S. Quebec, W. New Brunswick, Nova Scotia, and extreme E. Quebec, extending S. of St. Lawrence R. along mountains, to Pa. **N. p. acadicus** G. M. Allen. Smaller and paler than *N. p. palustris*.

753. MICROSOREX Baird

1242. **M. hoyi hoyi** (Baird). Hoy's Shrew. Very small and slender; ears large; olive brown. L. 3. T. $1\frac{1}{4}$. S. Ontario, S. Wisc., S. Minn. and N. W.; rare. (Lat., to Dr. P. R. Hoy.) **M. h. thompsoni** (Baird). Smaller. Nova Scotia to E. Ohio. **M. h. winnemani** Preble. Smaller; smallest of American mammals. Grayish brown. L. $2\frac{1}{2}$. S. W. Md. and Va. **M. h. intervectus** Jackson. More grayish than *M. h. hoyi;* the skull deeper. S. Quebec, W. Ontario, N. Wisc., and N. and N. W.

754. BLARINA Gray (A coined name)

1243. **B. brevicauda** (Say). Short-tailed Shrew. Mole Shrew. Size large for a Shrew; fur short and coarse; color dark ashy gray. L. $4\frac{1}{2}$. T. 1. Northern states, Minn. to Mo., and W. to Dak., in fields and woods; generally common, but rarely noticed. It has a fetid odor. (Lat., *brevi*, short; *cauda*, tail.) The Eastern form is **B. b. talpoides** (Gapper). **B. b. carolinensis** (Bachman); smaller; dull leaden-gray, washed with brownish. L. $3\frac{1}{4}$. T. $\frac{3}{4}$. S. U. S., north to Ind. and S. Va. **B. b. aloga** Bangs is described from Marthas Vineyard, and **B. b. compacta** Bangs from Nantucket.

1244. **B. telmalestes** Merriam. Similar to *B. brevicauda*, but more plumbeous; the molar teeth with the inner posterior lobe broad, rounded. L. $4\frac{2}{3}$. T. $1\frac{2}{10}$. Dismal Swamp. (Gr., *τέλμα*, swamp; *λέστης*, robber.)

755. CRYPTOTIS Pomel (Gr., *κρυπτός*, hidden; *οὖς*, ear)

1245. **C. parvus** (Say). Little Short-tailed Shrew. Body stout; iron gray, with brown gloss, tail very short. L. $3\frac{1}{4}$. T. $\frac{3}{4}$. Pa. to Neb. and Tex.; not common. Many other species occur S. W. in Mex. and Cent. and S. Am. (Lat., small.)

Family CCXXXVI. TALPIDAE (The Moles)

Body stout, thick, and clumsy, without distinct neck. Eyes rudimentary, sometimes concealed. No external ears. Limbs very short; feet greatly expanded and provided with strong claws, adapted for digging; anterior limbs much larger than posterior. Scapula as long as humerus and radius together. Canines usually distinct. Fur compact, soft, and velvety. Most species dig elaborate burrows.

a. Snout elongated, not star-shaped at tip; tail shorter than head.
b. Teeth $\frac{3\,1\,3\,3}{1\,0\,3\,3} = 36$; nostrils partly superior; tail nearly naked. . . . . Scalopus, 756.
bb. Teeth $\frac{3\,2\,3\,3}{3\,2\,3\,3} = 44$; nostrils lateral; tail densely hairy. . . . . Parascalops, 757.
aa. Snout elongated, fringed at tip with a circle of long fleshy projections; nostrils terminal; tail much longer than head; teeth $\frac{3\,2\,3\,3}{3\,2\,3\,3} = 44$. . . . . Condylura, 758.

756. SCALOPUS Geoffroy St. Hilaire (Gr., *σκάλοψ*, mole, from *σκάλλω* to dig)

1246. **S. aquaticus aquaticus** (Linnaeus). Common Mole. Dark plumbeous, paler below; feet full webbed; palms broader than long; eye not wholly covered by skin. L. $5\frac{1}{2}$. T. 1. Mass. to Pa. and S., very abundant. **S. a. machrinus** (Rafinesque); silvery plumbeous; larger and more silvery than the preceding; L. $6\frac{1}{4}$; T. $1\frac{1}{6}$; Mich. to Minn. and S., chiefly in the prairie region. **S. a. machrinoides** Jackson; smaller; Kans., N. W.

757. PARASCALOPS True (Gr., *παρά*, near; *Scalops*)

1247. **P. breweri** (Bachman). Hairy-tailed Mole. Brewer's Mole. Dark plumbeous, with brown gloss; palms narrow; tail densely hairy. L. 5. T. 1. N. B. to Ohio and mountains of N. C., in sandy regions; scarce. (Lat., to T. H. Brewer.)

758. CONDYLURA Illiger (Gr., *κόνδυλος*, node; *οὐρά*, tail)

1248. **C. cristata** (Linnaeus). Star-nosed Mole. Blackish; skull long and slender. L. $6\frac{3}{4}$. T. $2\frac{3}{4}$. Quebec, Ontario, S. to Ind., Ohio, and E. Ga., in wet meadows. (Lat., crested.)

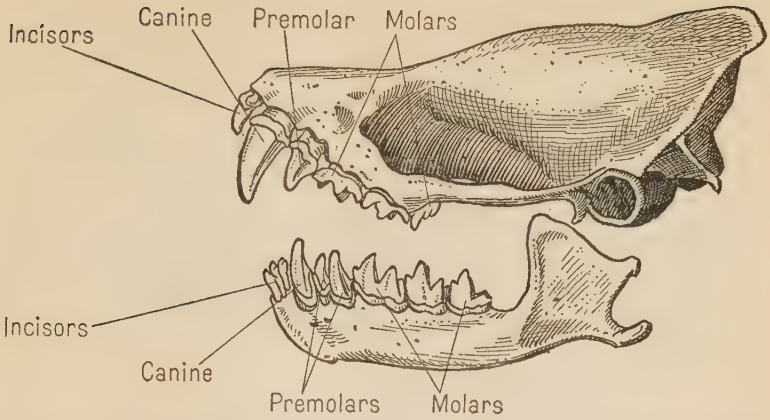


Fig. 10. Skull of a Bat (*Eptesicus*), showing the arrangement of teeth characteristic of the species in the order *Chiroptera*.

Order LIX. CHIROPTERA (The Bats)

Mammals with the anterior limbs modified for flight by the elongation of the fore arm, and especially of 4 of the fingers, all of which are connected by a thin leathery membrane, which includes the hind feet and usually the tail; humerus and femur not included in the common integument of the body; teeth with enamel, the 4 sorts differentiated; mammae pectoral. The Bats are chiefly nocturnal in their habits, going into retirement in daytime, and hanging, head downward, by their hind claws. Most of them are insectivorous, a few in tropical regions feeding on fruits. Nearly 1000 species are known, chiefly of small size. The order is very sharply defined, but it has probably sprung from the same stock as the Insectivora. (Gr., χείρ, hand; πτερόν, wing.)

a. Insectivorous; ears large; no leaf-like appendage to snout; hairs with imbricated scales arranged in spirals. Insect eaters. . . . . Vespertilionidae, CCXXXVII.

Family CCXXXVII. VESPERTILIONIDAE (The Northern Bats)

Insectivorous Bats with the snout not appendaged, or merely with two lateral excrescences; wing membranes ample; tail completely enclosed in the interfemoral membrane or only the last joint exserted; fur of peculiar structure, each hair with a series of minute imbricated scales arranged in spiral. Small Bats, especially abundant in temperate regions.

Count total No of Teeth for correct ans.

a. Nostrils simple, at tip of snout; ears moderate; forehead not grooved.

b. Incisors $\frac{2}{3}-\frac{2}{3}$.

c. Teeth 38; muzzle narrow, hairy in front of eyes; ears as long as head; slender species with thin wings and ears. . . . . MYOTIS, 759.

cc. Teeth 32 to 36; muzzle nearly naked before eyes; ears shorter than head; stout species with thick wings and ears.

d. Teeth 36: i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{3}{3}$. . . . . LASIONYCTERIS, 760.

dd. Teeth 34: i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{3}{3}$. . . . . PIPISTRELLUS, 761.

ddd. Teeth 32: i. $\frac{2}{3}$; c. $\frac{1}{1}$; pm. $\frac{1}{2}$; m. $\frac{3}{3}$. . . . . EPTESICUS, 762.

bb. Incisors $\frac{1}{3}-\frac{1}{3}$.

e. Teeth 30; upper incisors small; wings and interfemoral membranes nearly naked. NYCTICEIUS, 763.

ee. Teeth 32; upper incisors stout; interfemoral membranes hairy above, the wings with furry patches. . . . . NYCTERIS, 764.

aa. Nostril margined behind by grooves and glandular prominences; cheeks with large excrescences; ears very large (an inch high); teeth 36. . . . CORYNORHINUS, 765.

Examine closely behind canines

759. MYOTIS Kaup (Gr., *μῦς*, mouse; *οὖς*, ear)

1249. **M. lucifugus lucifugus** (Le Conte). BROWN BAT. Ear and tragus short and broad, the ears not extending beyond nostril when laid forward; color dull olive brown, with a darker area at the shoulder. L. 3½. E. N. Am.; common. (Lat., shunning light.)

1250. **M. austroriparius** (Rhoads). AUSTRORIPARIAN BROWN BAT. Similar to *M. l. lucifugus*, the fur on the back shorter and more dense, woolly, and the dark bases and burnished tips of the hairs less conspicuous; color dull yellowish or drabby brown. L. 3½. Fla. to Ind. (Lat., Austroriparian [Life Zone]).

1251. **M. grisescens** Howell. SOUTHERN CAVE BAT. Differs from all other known North American species in the insertion of the wing membrane at the tarsus instead of the side of the foot and in the absence of dark bases to the hairs of the back; color dark drab to cinnamon brown. L. 3½. E. Tenn., S. Ill., and Mo., S. to N. Ark. and Ala. (Lat., grayish.)

1252. **M. keenii septentrionalis** (Trouessart). LONG-EARED BROWN BAT. Face small, fox-like, with high forehead and pointed snout; ears large, slender, nearly twice the height of the erect targus; ears reaching beyond nostril when laid forward; fur on back with darkened basal area, but without tricolor pattern; color dull olive brown. L. 3½. E. N. Am., from N. F., Que., and N. D., S. to S. C. and Ark. (Lat., northern.)

1253. **M. sodalis** Miller and Allen. Similar to *M. l. lucifugus*, with slightly longer tail and smaller foot, and more pinkish gray coloration; fur of back with an obvious tricolor pattern; color dull grayish chestnut. L. 3½. E. U. S., from N. H. and S. Mich., S. to N. E. Ark. and N. Ala. (Lat., a comrade.)

1254. **M. subulatus leibii** (Audubon and Bachman). LEAST BROWN BAT. Small; with comparatively small foot, less than one-half length of tibia; color

resembling that of *M. l. lucifugus*, but slightly more golden, lacking the dark spot on the shoulder, and with more blackish muzzle. L. 3. N. E. U. S., from N. H., W. to N. W. Ohio, S. to W. Va. and Ky. (Lat., to Dr. George C. Leib.)

760. LASIONYCTERIS Peters (Gr., λασιός, woolly; νύκτερις)

1255. **L. noctivagans** (Le Conte). Silver-haired Bat. Tragus almost as broad as high, scarcely ⅓ height of ear; femoral membrane entirely, though scantily, furred; fur long and silky, black, usually with silvery tips to the hairs. L. 3½. E. 12. T. 1½. U. S., generally, migrating southward in winter; easily known by its color. (Lat., *nox*, night; *vagans*, wandering.)

761. PIPISTRELLUS Kaup (Italian *pipistrello*, from *vespitrello*, dim. of *vespertilio*, bat)

1256. **P. subflavus subflavus** (F. Cuvier). Georgian Bat. Tragus slender, erect, half the height of the ear; upper incisors about equal in size; femoral membrane one-third furred; yellowish brown, brighter forwards. L. 3. E. 9. T. 1½. N. Y. to Iowa and Texas; chiefly southward. (Lat., rather yellowish.) **P. s. obscurus** Miller, has the colors duller, less yellow above. Central and E. N. Y.

762. EPTESICUS Rafinesque (Gr., ἔπιην, to fly; οἶκος, house)

1257. **E. fuscus fuscus** (Beauvois). Big Brown Bat. Tragus never pointed, nearly half as high as ear; wings naked; interfemoral membrane furred at base; ear more or less turned outward; upper lateral incisors small, scarcely visible. L. 4. E. 12. T. 1½. Me. to Brit. Col., S. to Ariz. and Gulf coast; common. Smaller than the allied European species, *Vespertilio serotinus*. (Lat., dusky.)

763. NYCTICEIUS Rafinesque (Gr., νύξ, night)

1258. **N. humeralis** Rafinesque. Twilight Bat. Ears small, wide apart; a small wart above eye; fur rather scanty. Dark fawn-color above, passing into brownish below. L. 3⅓. E. 9. T. 1⅓. S. Pa. to Mo. and S.; common. (Lat., with a cape.)

Lasiurus

764. NYCTERIS Borkhausen (Gr., νυκτερίς, bat)

1259. **N. borealis** (Müller). Red Bat. Fur long and silky, reddish brown, mostly white at tips; lips and ears not edged with black; a whitish tuft at base of thumb. L. 3¾. E. 12. T. 1¾. E. U. S.; everywhere very abundant. Known by its reddish color. (Lat., boreal.)

1260. **N. cinerea** (Beauvois). Hoary Bat. Much larger. Rich chocolate-brown, overlaid with white; lips and ears marked with black. L. 5. E. 14. T. 2¼. U. S., northward, migrating south in winter; rare. (Lat., gray.)

765. CORYNORHINUS Harrison Allen (Gr., *κορύνη*, club; *ῥίν*, nose)

1261. **C. macrotis** (Le Conte). Big-eared Bat. Known by its large size and very large ears. Blackish; fur soft and long. L. 3½. E. 11. T. 1¾. Va. to La. (Gr., *μακρός*, large; *οὖς*, ear.)

1262. **C. rafinesquii rafinesquii** (Lesson). Paler, not bicolor. W. Va. to Kans. (For Constantine Samuel Rafinesque.)

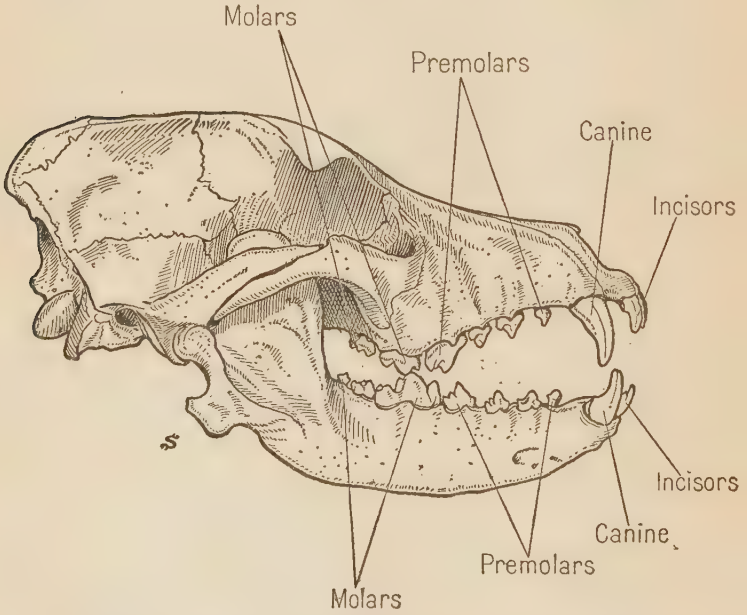


Fig. 11. Skull of a Dog, showing the tearing and cutting type of teeth, which is characteristic of the species in the order *Carnivora*.

Order LX. CARNIVORA (The Flesh Eaters)

Canine teeth distinct, conical; molars more or less adapted for cutting; clavicles imperfect or wanting; toes provided with claws; skin covered with hair or fur; alimentary canal short. General structure in accordance with the

predatory life led by all these animals. (The name *Ferae* of Linnaeus is much older than Cuvier's term *Carnivora*, which is in general use.)

Families of Carnivora

a. Limbs short, unfitted for walking; the toes united in a flat paddle, from which only the claws project; no external ear; tail very short; eyes large; incisors often less than $\frac{6}{6}$. (*Pinnipedia.*)

b. Hind limbs directed backwards, used only in swimming; claws strong; neck short. PHOCIDAE, CCXLIII.

aa. Limbs fitted for walking; the toes distinct; incisors $\frac{6}{6}$.

b. Hind feet with 5 toes.

c. Feet fully plantigrade; sectorial teeth and the molars behind them all tuberculate.

d. Tail well developed; the snout sharp. . . . . PROCYONIDAE, CCXXXIX.

dd. Tail rudimentary; snout not acuminate. . . . . URSIDAE, CCXXXVIII.

cc. Feet sub-plantigrade or digitigrade; only one tuberculate molar, the sectorial premolar of typical form. . . . . MUSTELIDAE, CCXL.

bb. Hind feet with 4 toes; feet digitigrade.

e. Teeth 42; claws not retractile; snout more or less produced. . CANIDAE, CCXLI.

ee. Teeth 28 to 30; claws retractile into a sheath; snout short, the head broad. FELIDAE, CCXLII.

FAMILY CCXXXVIII. URSIDAE (THE BEARS)

Plantigrade Carnivora, having the body thick and clumsy. Tail rudimentary. Teeth 42; molars $\frac{2}{3}$, broad and tuberculated, their form according with the omnivorous diet. Species about 15, mostly widely distributed. The Polar Bear, *Thalarctos maritimus* (Phipps), occurs to the northward of our limits, and the huge Grizzly Bear, *Ursus horribilis* [1] Ord, now nearly extinct, to the westward.

a. Snout depressed, so that the profile does not form a straight line; soles not fully furred; claws moderate. Size medium, smaller than in the genus *Ursus*. . . EUARCTOS, 766.

766. EUARCTOS Gray (Gr., ἐυ, true; ἄρκτος, bear)

1263. **E. americanus americanus** (Pallas). BLACK, or CINNAMON BEAR. Color black or brownish. N. Am., not rare in unsettled regions. (Lat., of America.) Several other species of *Ursus* and *Euarctos* occur N. W. and in Alaska.

FAMILY CCXXXIX. PROCYONIDAE (THE RACCOONS)

Plantigrade Carnivora of moderate size, with the body comparatively slender and the tail well developed. Teeth i. $\frac{3}{3}-\frac{3}{3}$; c. $\frac{1}{1}-\frac{1}{1}$; pm. $\frac{4}{4}-\frac{4}{4}$; m. $\frac{2}{2}-\frac{2}{2}=40$.

[1] Coward, — of heroic size
In whose lazy muscles lies
Strength we fear and yet despise;
Savage, whose relentless tusks
Are content with acorn husks;
Robber, whose exploits ne'er soared
O'er the bee's or squirrel's hoard;
Whiskered chin and feeble nose,
Claws of steel on baby's toes.
BRET HARTE

Sectorial tooth broad, tubercular. Snout more or less elongated; no caecum. Species few, all American.

a. Tail not prehensile; snout moderate, not flexible. . . . . PROCYON, 767.

767. PROCYON Storr (Gr., *πρoκύων*, before the dog)

1264. **P. lotor lotor** (Linnaeus). COMMON RACCOON. COON. Grayish white; hairs black-tipped; tail with black rings; a black cheek patch; body rarely entirely black. L. 33. T. 10½. E. U. S., W. to the Rockies; common locally. (Lat., one who washes.)

FAMILY CCXL. MUSTELIDAE (THE WEASELS)

Carnivora, either plantigrade or digitigrade, with the toes 5–5. Molars $\frac{1}{2}-\frac{1}{2}$ $\left(\text{rarely } \frac{1}{1}-\frac{1}{1}\right)$; the upper and the last lower one tubercular; sectorial premolar without tubercles; no caecum. Most species provided with glands near the anus which secrete a fetid liquid. Some are strictly carnivorous, while others are rather omnivorous. Size usually medium or small; the largest, the Sea Otter, being 4 feet long, the smallest weasels less than a foot. *Mustelidae* are found in all parts of the earth excepting the Australian region. Some of the species are aquatic, and one, *Enhydra lutris*, the Sea Otter of the North Pacific, inhabits the sea, the young being born in the kelp. This most valuable species is now nearly extinct through careless neglect of the rulers of Alaska. "One does not keep faith with fur-bearing animals" (*Veblen.*) The most valuable fur-bearing animals are in this family.

a. Skull with the cerebral portion swollen backwards and outwards, the snout short, high, and truncate forwards; toes webbed; the feet adapted for swimming; teeth 36; aquatic. (*Lutrinae.*) . . . . . LUTRA, 768.

aa. Skull with the cerebral portion posteriorly somewhat compressed, the snout produced, attenuate and transversely convex above; feet scarcely webbed; mostly non-aquatic.

b. Auditory bulla little inflated, constricted; last upper molar above quadrangular, very large, with an outer cutting ridge; claws non-retractile; fore claws lengthened, fossorial. (*Mephitinae.*)

c. Teeth 34; tail long and bushy; anal secretion very strong-scented.

d. Skull not depressed, its upper outline irregularly convex. Large skunks. MEPHITIS, 769.

dd. Skull depressed, its upper outline nearly straight. Small skunks. SPILOGALE, 770.

bb. Auditory bulla much inflated, not constricted.

e. Last molar of upper jaw enlarged, sub-triangular; toes straight with long, non-retractile claws. (*Taxidiinae.*)

f. Body robust; tail very short; teeth 32. . . . . TAXIDEA, 771.

ee. Last molar of upper jaw short, transverse; toes short, arched, the claws retractile. (*Guloninae.*)

g. Feet sub-plantigrade; body stout; tail very full and bushy; teeth 38. GULO, 772.

gg. Feet digitigrade; body slender. (*Mustelinae.*)

h. Teeth 38; sectorial tooth with an internal tubercle. . . . . MARTES, 773.

hh. Teeth 34; sectorial tooth without internal tubercle.

i. Pads of palm coalescent; toes webbed, tail bushy. . . . LUTREOLA, 774.

ii. Pads of palm distinct; toes not webbed; tail slender. . . . MUSTELA, 775.

768. LUTRA Linnaeus (Lat., otter)

1265. **L. canadensis canadensis** (Schreber). American Otter. Liver brown. L. 45. T. 15. E. N. Am. S. to N. C., aquatic. Valued for its fur. Remotely allied to *Lutra* is *Enhydra lutris* (Linnaeus), the Sea Otter of the Northern Pacific. (Lat., Canada.)

769. MEPHITIS Geoffroy and Cuvier (Lat., a bad odor)

1266. **M. nigra** (Peale and Beauvois). Common Skunk. Polecat. Black, with white frontal stripe; a nuchal patch, from which 2 lateral bands extend along sides to tail; tip of tail white, the amount of white subject to much variation. N. E. to Ind., S. to Va.; generally common. A handsome but most offensive animal. (*Mephitis putida* Boitard.) (Lat., black.)

1267. **M. mesomelas mesomelas** Lichtenstein. Louisiana Skunk. White dorsal stripe short and narrow; tail medium, tapering to a point; feet very small, smaller than in the common skunk, and variable. La. to Tex. and Mo. **M. m. avia** (Bangs), the tail very short; in prairies, Iowa and Ill. and S. (Gr., μεσός, midway; μελός, black.)

1268. **M. mephitis** (Schreber). Northern Skunk. Rather small, stripes narrower than in *M. nigra*, the tail black and white. Quebec to Manitoba, Northern only. (Lat., a bad odor.)

1269. **M. hudsonica** (Richardson). Hudson Bay Skunk. Size larger, tail heavy and ending in a blunt brush without white pencil. Wisc., Minn., and N. W. (Lat., Hudson [Bay].)

770. SPILOGALE Gray (Gr., σπίλος, spot; γαλῆ, weasel)

1270. **S. interrupta** (Rafinesque). Little Spotted Skunk. Black, with white patch on forehead; 4 parallel dorsal stripes, broken behind into spots; tail black, with white pencil tuft at tip. Size very small. L. 15. T. 4. S. Minn. and S. (Lat., interrupted.)

1271. **S. putorius** (Linnaeus). Similar to *S. interrupta;* white of tail more extensive; skull " broader across the postorbital processes, and interorbitally, has better developed postorbital processes and a decided postorbital constriction." Va. and W. Va. to Miss. (Lat., *putor*, a foul odor.)

771. TAXIDEA Waterhouse (Lat., a badger)

1272. **T. taxus taxus** (Schreber). American Badger. Chiefly grayish. L. 27. T. 5. Wisc. to Tex. and W.; formerly E. to Ohio, now becoming rare.

772. GULO Pallas (Lat., glutton)

1273. **G. luscus** (Linnaeus). Wolverene. Blackish; a pale lateral band meeting its fellow above root of tail; forehead pale; fur shaggy. L. 30. T. 8. N. U. S. and Canada, N.; becoming rare S. (Lat., one-eyed, or pur-

blind " from the sad state of the specimen on which the species was based! ") (*Coues.*)

773. MARTES Pinel (Lat., a marten)

(*Mustela* of authors, not of Linnaeus, as now restricted)

a. Ears high, subtriangular (Martens). (*Martes.*)

1274. **M. americana americana** (Kerr). Pine Marten. American Sable. Brown, not darker below than above, usually a tawny throat patch. Ears high, sub-triangular. L. 24. T. 8. Formerly Pa. N. to S. Labrador and W.; now extinct, or nearly so in E. U. S. (Lat., America.)

aa. Ears low (Fishers). (*Pekania* Gray.)

1275. **M. pennanti pennanti** (Erxleben). Fisher. Pekan. Blackish, paler anteriorly, darkest below; no throat patch; ears low, semicircular. L. 35. T. 14. Formerly Pa. to Hudson Bay, and W.; now extinct or nearly so in E. U. S. (Lat., to Thomas Pennant, author of Arctic Zoölogy.)

774. LUTREOLA Cuvier

Large species; length 20 to 28 inches; color dark brown or yellowish; not white in winter; tip of tail not abruptly black.

1276. **L. vison vison** Schreber. Mink. Dark chestnut brown; uniform or somewhat whitish below. L. 22. T. 8. Aquatic, found in most parts of Northern America, the typical form not approaching the seaboard S. of Me. (Lat., *vison*, a scout.) Represented S. of Me. and W. to Ind. by **L. v. mink** Peale and Beauvois, the Big Brown Mink; L. 25; T. 8¾. Represented from N. Wisc. and Minn., S. to N. Ill. and Kans. by **L. v. letifera** Hollister. **M. v. lacustris** Preble occurs from Hudson Bay S. W. to N. D.

775. MUSTELA Linnaeus (*Putorius* Cuvier) (Lat., a weasel)

Smaller species. L. 10 to 17. Color tawny, becoming white in winter.

b. Tail long, about 6 inches, 1½ in rest of body. L. 16½.

1277. **M. longicauda longicauda** (Bonaparte). Long-tailed Weasel. Neck long; ears conspicuous, orbicular; tail slender; toes cleft; pads on feet separate; coloration bicolor, reddish brown above, yellowish or white below, the fur usually becoming snow white in winter. Belly tawny or salmon-yellow; black tip of tail reduced to a terminal pencil; tail long. L. 16½. T. 6. Kans. and N. (Lat., long-tailed.) **M. l. spadix** (Bangs); much darker; Minn.

bb. Tail shorter, about 5 inches in length, 2 in rest of body.

1278. **M. noveboracensis noveboracensis** (Emmons). Large Weasel. New York Weasel. Ermine. Stoat. Belly sulphur yellow; black of tail not confined to tip; fur snow white in winter only in N. L. 15. T. 5. Me. to N. C. and W. to Ill.; common N. Allied to the European Ermine, *Mustela erminea* (Linnaeus). This, like the other species, runs into many variants. (Lat., To New York.)

1279. **M. occisor** (Bangs). Like the preceding, but black tip of tail very short, the body larger. Me., rare. (Lat., murderer.)

bbb. Tail still shorter; smallest of the weasels. L. 7.

1280. **M. rixosa rixosa** (Bangs). Least Weasel. Tail without black tip. Minn. and N. W. (Lat., quarrelsome.) **M. r. alleghaniensis** (Rhoads), darker, the dark of the upper parts encroaching on belly, is found from Pa. to Wisc., S. to N. C.

bbbb. Tail very short, 3 in rest of body. Length of body 10 inches.

1281. **M. cicognanii cicognanii** Bonaparte. Short-tailed Weasel. Mahogany brown, white, rarely yellowish below; white in winter. Very small. L. 10. T. 2½. New England to Minn., and along mountains to Pa.

Family CCXLI. **CANIDAE** (The Dogs)

Digitigrade Carnivora, with blunt, non-retractile claws; toes 5–4. Muzzle more or less elongated. Dentition typically i. $\frac{3-3}{3-3}$ c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{4-4}$; m. $\frac{2-2}{3-3} = 42$; canines large, rather blunt. Species widely distributed, all of them more or less dog-like or fox-like in habit.

a. Pupil elliptical; tail long and bushy; upper incisors scarcely lobed; body rather slender.
b. Tail with soft fur and long hair; muzzle long. . . . . Vulpes, 776.
bb. Tail with a concealed mane of stiff hairs, and without soft fur; muzzle shorter. Urocyon, 777.
aa. Pupil circular; tail moderate; upper incisors distinctly lobed. . . . . Canis, 778.

776. **VULPES** Oken (Lat., fox)

1282. **V. fulva fulva** (Desmarest.) Red Fox. Chiefly reddish gray, with black feet and ears; tip of tail white. The chief variants, the Cross Fox, with a dark cross on the back, the Black Fox, and the Silver Fox, intergrade fully with the common Red Fox. L. 45. T. 15. N. E. U. S.; once common. Closely allied to the European fox, *V. vulpes* Linnaeus. (Lat., reddish yellow.)

1283. **V. rubricosa rubricosa** Bangs. Nova Scotia Red Fox. A larger red fox, the tail very dark, with a basal ring. Nova Scotia, N. (Lat., full of red ochre.)

1284. V. **regalis** Merriam. Northern Red Fox. Larger and brighter colored. N. Wisc. and Minn., and N. W. (Lat., royal.)

777. UROCYON Baird (Gr., οὐρά, tail; κύων, dog)

1285. **U. cinereoargenteus cinereoargenteus** (Schreber). Gray Fox. A dog-like fox, smaller than the red fox. Chiefly gray; fur dusky or tawny, the hairs hoary at tip. L. 40. T. 14. Pa. to Ga. and Mich.; never very common. Runs into many variants. (Lat., gray silvery.) **U. c. borealis** Merriam is larger, with the 4th lower premolar much enlarged; N. H. **U. c. ocythous** Bangs, large and pale; Wisc.

778. CANIS Linnaeus

a. Size relatively small, coyotes (*Thos* Oken).

1286. **C. latrans latrans** Say. Coyote. Prairie Wolf. Yellowish gray, clouded with black; fur coarse; snout sharp. L. 55. T. 11. Ill. and N. W. Common on the Great Plains, burrowing in the ground. A vagabond, dog-like animal, "half bold and half timid, yet lazy all through." (Lat., barking.)

aa. Size large, timber wolves. (*Canis.*)

1287. **C. lycaon** Schreber. Timber Wolf. Gray Wolf. Chiefly gray, the color variable, becoming darker or almost black in Florida, reddish in Texas, dusky N. W. L. 65. T. 15. United States, E. of Rocky Mts.; formerly common. Other related species occur W. and N. (Gr., λυκάων, wolf kind.) The Dog, *Canis familiaris* Linnaeus, is closely allied to the wolf, and in part at least derived from the European species (*Canis lupus* Linnaeus); some dogs may have come from other species.

Family CCXLII. FELIDAE (The Cats)

Digitigrade Carnivora, with the toes 5–4; claws compressed, very sharp, retractile; palms and soles hairy, with naked pads under each toe and the ball of the foot. Body compact; head short, broad, and rounded. Dentition i. $\frac{3-3}{3-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{3-3}{2-2}$ or $\frac{2-2}{2-2}$; m. $\frac{1-1}{1-1}$ = 30. or 28; canine teeth long and sharp; teeth all sharp; tongue with short, retrorse papillae. General aspect cat-like. Species numerous, found in almost all parts of the world excepting Australia and its islands. "The fiercest, strongest, and most terrible of beasts," "brave when hungry and in the dark, cowardly or lazy in the daytime, and magnanimous when not in need of food." The common House Cat (*Felis domesticus* Schreber), one of the smallest of the *Felidae*, is a familiar representative of the group.

a. Premolars (anterior upper one wanting); tail less than half length of body proper; ears triangular, tufted. . . . . LYNX, 779.
aa. Premolars (anterior upper one very small); tail at least half as long as the body (exclusive of head and neck); fur compact and glossy; ears not tufted. . FELIS, 780.

779. LYNX Kerr (Gr., λύγξ, wild cat)

1288. **L. canadensis** (Kerr). CANADA LYNX. Feet very large, densely furred beneath in winter, concealing the small, naked patches. Grayish hoary, waved with black; tail black at tip; no distinct bars on inner sides of legs; larger than the next, with larger feet and longer fur. L. 39. T. 4½. Northern N. Am., formerly S. to N. Y. (Lat., of Canada.)

1289. **L. rufus rufus** (Schreber). WILD CAT. BOBCAT. LYNX. Reddish, overlaid by grayish; inner sides of legs with dark cross-bands; tail with a black patch at end above, preceded by half rings. L. 35. T. 7. E. N. Am. (Lat., reddish.)

1290. L. gigas Bangs. Larger and brighter, much spotted and streaked. N. S. (Lat., giant.)

780. FELIS Linnaeus (Lat., cat)
(Subgenus *Puma* Pocock)

1291. **F. couguar** Kerr. AMERICAN PANTHER. COUGAR. MOUNTAIN LION. PUMA. Above tawny brownish yellow; a wash of darker along dorsal line, dirty white below; kittens spotted, their tails ringed. L. 90. T. 32. America, N. to S. Canada, now exterminated, or nearly so, in E. U. S. A large cat. (A Mexican name, usually written Cougar.)

FAMILY CCXLIII. PHOCIDAE (THE TRUE SEALS)

Seals with the fore limbs well forward; neck short; hind limbs directed backward, useless on land; hand and foot hairy; nails usually well developed; no external ear. Species numerous; found on most coasts, swimming freely in the water and feeding chiefly on fishes, resting and sunning in the rocks on the shore, sometimes breeding on floating ice. (See Figure 12, page 384, for arrangement of teeth.)

a. Teeth 34, incisors $\frac{3-3}{2-2}$; interorbital region very narrow; nails of all digits well developed. (*Phocinae.*)
b. Snout narrow; incisors simple, conical; molars with 2 to 4 cusps. . . . PHOCA, 781.
bb. Snout sharp and thick; molars with a single cusp. . . . . HALICHOERUS, 782.
aa. Teeth 30, snout with a short proboscis inflatable at the node. . . . CYSTOPHORA, 783.

781. PHOCA Linnaeus (Gr., φόκη, seal)

1292. **P. vitulina concolor** (De Kay). HARBOR SEAL. HAIR SEAL. Yellowish gray, usually spotted or blotched with darker above; variable. Fore

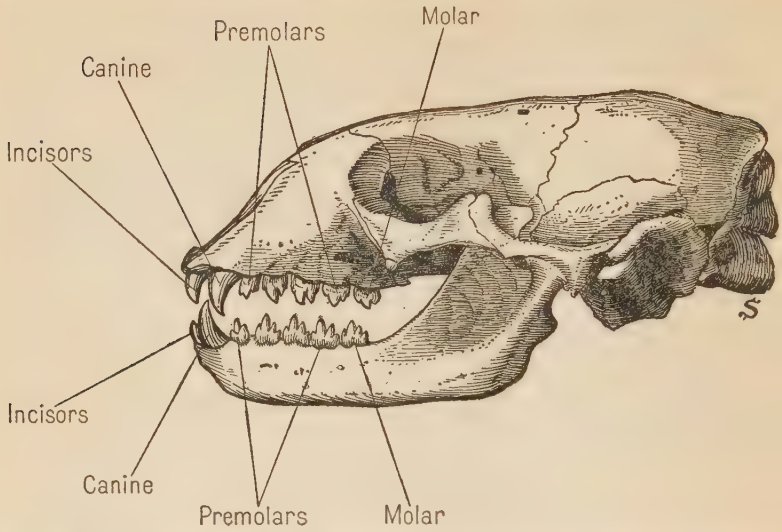


FIG. 12. Skull of a Seal (*Phoca*), showing the arrangement of teeth characteristic of the species in the family *Phocidae* (formerly of the suborder *Pinnipedia* of the order *Carnivora*, and considered by some a separate order).

feet short with 5 strong curved claws, subequal; hind claws shorter, less curved. L. 4 to 5 feet. N. Atl., S. to N. J.; common N., seldom far from shore. A near relative to *Phoca richardii* (Gray) of the Pacific. (*Eu.*) (Lat., one color.)

1293. **P. groenlandica** Erxleben. HARP SEAL. ICE-RUNNING SEAL. Gray, with black face and black shoulder band extending along sides. Weight 600 to 800 lb. Young born on ice floes. Arctic Seas, rarely S. to Mass. Basis of a great industry in Newfoundland. (Lat., of Greenland.)

782. HALICHOERUS Nilsson (Gr., ἅλς, sea; χοῖρος, pig)

1294. **H. grypus** (Fabricius). GRAY SEAL. Gray, with irregular dark spots; flippers hairy along toes. Size larger. N. Atl., S. to Nova Scotia. (Gr., γρυπος, hook-nosed.)

783. CYSTOPHORA Nilsson (Gr., κύστις, bladder; φορός, bearing)

1295. **C. cristata** (Erxleben). HOODED SEAL. Blackish, with whitish spots; still larger. L. 8 to 9 feet. N. Atl., occasionally S. to L. I. (Lat. crested.)

Order LXI. GLIRES (The Rodents or Gnawers)

Mammals with the incisor teeth $\frac{1}{1}$ or $\frac{2}{2}$ in number, chisel-shaped, adapted for gnawing; no canine teeth, a toothless space in the place of canines; molar teeth adapted for grinding; cerebrum small, little convoluted; intestinal canal elongate; ears and eyes usually well developed. Food chiefly vegetable.

The *Glires* or *Rodentia* is the largest order of Mammals, and in individuals by far more numerous than any other. Most of the species are of small size, the Beaver being one of the very largest of the forms now living. By some authorities the hares and p kas are included in a separate order, *Lagomorpha*.

" Though a feeble folk, comparatively insignificant in size and strength, they hold their own in legions against a host of natural enemies, rapacious beasts and birds, by their fecundity, their wariness and cunning, their timidity and agility, their secretiveness, each after the means by which it is provided for exercising its instinct of self-preservation, among which insignificance itself is no small factor." (*Coues.*) (Lat., *glis*, dormouse; the Linnaean name *Glires* is much older than Cuvier's *Rodentia*.)

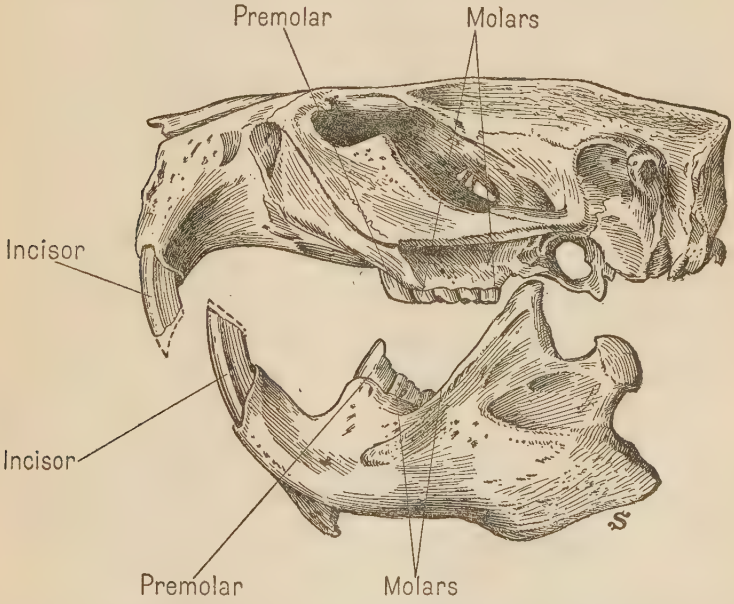


Fig. 13. Skull of a Beaver, showing the arrangement of teeth characteristic of the species in the order *Glires*. In this order the incisors are excessively developed into chisel-like cutting organs, and the canines are entirely absent.

Families of Glires (=Rodentia)

a. Incisors $\frac{1}{1}$, the median upper incisors large, vertically grooved, the outer small; teeth 28; tail very short; ears long; fibula united with the heel-bone. . . LEPORIDAE, CCL.
aa. Incisors $\frac{2}{1}$; tail well developed.
b. Fur with stiff spine-like bristles; tibia and fibula separate. ERETHIZONTIDAE, CCXLIX.
bb. Fur more or less soft, without spines.
c. Tibia and fibula united below.
d. Tail and hind legs excessively elongated, the latter adapted for leaping; molars $\frac{1}{1}$ on each side. . . . . ZAPODIDAE, CCXLVIII.
dd. Tail and hind legs not excessively elongated.
e. Limbs very short, subequal, adapted for digging; fore claws much enlarged; large, external cheek pouches; body thickset and heavy; molars $\frac{1}{1}$ on each side. GEOMYIDAE, CCXLV.
ee. Limbs moderate, not as above; cheek pouches usually absent; molars $\frac{3}{3}$ to $\frac{1}{1}$ on each side. . . . . MURIDAE, CCXLVII.
cc. Tibia and fibula separate.
f. Tail broad, flat, and scaly; feet webbed; molars $\frac{2}{2}$ on each side; body robust. CASTORIDAE, CCXLVI.
ff. Tail with fur; feet not webbed; molars $\frac{1}{1}$ or $\frac{2}{2}$ on each side. SCIURIDAE, CCXLIV.

Tail not well furred nor spatulate

FAMILY CCXLIV. SCIURIDAE (THE SQUIRRELS)

Molars rooted, $\frac{4 \text{ or } 5}{4} - \frac{4 \text{ or } 5}{4}$ (upper anterior often deciduous), the last 4 of nearly equal size; a distinct postorbital process of frontal bone; tibia and fibula distinct. Species numerous, of rather small size, in all parts of the world except Australia. The squirrels easily adapt themselves to climatic and other conditions, thereby forming numerous local species and varieties.

a. Sides without membrane for "flying."
b. Upper outline of skull nearly straight; frontal region depressed; cheek pouches rudimentary; thumb with a broad flat nail; tail short, bushy; ears small; fur coarse, heavy; body stout, clumsy.
bb. Upper outline of skull more or less convex. . . . . MARMOTA, 784.
c. Cheek pouches present; tail moderate.
d. Skull comparatively thin.
e. Thumb with rudimentary nail (other characters drawn from the skull). First upper molar *small*, but not *minute*. . . . . CITELLUS, 785.
ee. Thumb with well-developed nail; skull narrowed anteriorly.
f. Premolars $\frac{2}{2}$; size very small . . . . . EUTAMIAS, 786.
ff. Premolars $\frac{1}{1}$; size moderate. . . . . TAMIAS, 787.
cc. Cheek pouches wanting; tail very long and bushy, the hairs mostly on its sides; skull short, broad, and rounded; first upper molar when present *minute*, thumb nail rudimentary; eyes well developed. . . . . SCIURUS, 788.
aa. Sides with a densely furred lateral membrane joining the anterior and posterior limbs; body and tail depressed; no cheek pouches; ears large; molars subequal in size. GLAUCOMYS, 789.

784. MARMOTA Blumenbach (*Arctomys* Schreber)
(Lat., marmot)

1296. **M. monax monax** (Linnaeus). WOODCHUCK. GROUND HOG. Grizzly gray, varying to chestnut and blackish. L. 18. T. 5. N. Iowa to N. J., S. to Va., Ala., and N. E. Okla., common, burrowing in the ground, popularly,

but erroneously, regarded as a weather prophet. (Lat., *lone.*) **M. m. canadensis** (Erxleben) is a small dark race with short ears and tail, from Nova Scotia, Me., N. Mich., N. Minn., and N. and N. W. **M. m. rufescens** Howell; more reddish in color, W. Mass., W. to E. N. D. **M. m. preblorum** Howell; smaller and paler; from Me. to Vt.

785. CITELLUS Oken (*Spermophilus* Cuvier)
(Lat., the ziesel or souslik)

a. Skull very long and narrow, the snout broad and very long; tail long; ear small.

1297. **C. franklinii** (Sabine). Gray Gopher. Gray Ground Squirrel. Franklin's Spermophile. Yellowish brown, mottled with wavy lines of black. Tail long. L. 15. T. 5½. F. 2. Prairies; N. Ill. and N. W., introduced in New Jersey. (Lat., for John Franklin.)

1298. **C. richardsonii** (Sabine). Flickertail. Richardson's Ground Squirrel. Grayish buffy with black hairs and no distinct markings. Tail short. L. 12¼. T. 3¼. F. 2. Dak. and N. W. (Lat., for John Richardson.)

1299. **C. tridecemlineatus tridecemlineatus** (Mitchill). Striped Gopher. Striped Ground Squirrel. Dark brown, mixed with reddish, with 6 to 8 light stripes alternating with lines of dots, about 13 streaks in all; yellowish below. L. 10½. T. 3½. Prairies; Indiana to Mich. and N. W.; common. (Lat., 13-lined.) **C. t. badius** Bangs, Mo., larger and darker.

Very many other species of *Citellus* (Spermophiles) and related genera occur westward.

786. EUTAMIAS Trouessart (Gr., *εὖ*, typical + *Tamias*)

1300. **E. minimus jacksoni** Howell. Lake Superior Chipmunk. Back with black and pale stripes, bright colored. L. 8. T. 4. Mich., Wisc. and Minn. (Lat., for H. H. T. Jackson.) Represented N. of L. Superior, and in N. N. D. by **E. m. borealis** (Allen), the colors duller and heavier, and paler. Many other species of these dainty little creatures occur in western North America, and in Siberia.

787. TAMIAS Illiger (Gr., *ταμίας*, steward)

1301. **T. striatus striatus** (Linnaeus). Chipmunk. Ground Squirrel. Reddish brown; back with 5 black stripes and 2 whitish ones; rump reddish. L. 11. T. 4½. S. Va. and S., abundant. (Lat., striped.) **T. s. fisheri** Howell; paler than *T. s. striatus;* S. N. Y. to Va., W. to Ohio. **T. s. lysteri** (Richardson) is larger and paler than *T. s. fisheri,* which it replaces to the north; L. Huron to Me. and Hudson Bay, S. to N. N. Y. and Mass. **T. s. griseus** Mearns is larger and grayer than the common chipmunk, the reddish tints less marked; L. 11; Wisc. and western Ontario, W.

Citellus tridecemlineatus

788. SCIURUS Linnaeus (Gr., *σκίουρος*, squirrel [*σκία*, shade; *οὐρά*, tail])

a. Red Squirrels (*Tamiasciurus* Trouessart).

1302. **S. hudsonicus hudsonicus** (Erxleben). Red Squirrel. Chickaree. Yellowish gray, back with a median wash of bright rusty red; tail short and narrow, with a subterminal band of black and a yellowish fringe; the typical form in mountains or cold regions, and having the white underparts vermiculated with black, especially in winter. L. 14. T. 6½. Que., Ont., and N. W.; abundant N. (Lat., of Hudson [Bay].) **S. h. loquax** Bangs, the Southern form, common on lower grounds and southward, Mass. to Wisc., S. to Va.; more rusty, less olive, and rather larger, underparts pure white, not vermiculated. **S. h. gymnicus** Bangs, N. E. N. Y. and N. E; smaller fringe of tail red. **S. h. minnesota** Allen, from Minn., larger and paler.

aa. Gray squirrels (*Sciurus* Linnaeus).

1303. **S. carolinensis carolinensis** Gmelin. Gray Squirrel. Black Squirrel. Cat Squirrel. Whitish gray, usually varied with tawny; middle of back brownish; ears not tufted; often entirely jet black, the gray and black forms belonging to the same species. L. 18. T. 8. S. N. Y., Ind., Mo., S. to N. Fla. and N. La.; in hardwood forests. (Lat., from Carolina.) The Northern form is **S. c. leucotis** (Gapper), larger, the brownish band on back narrow. Mass., N. Y., Wisc., and S. to N. Pa. and N. Ill. **S. c. hypophaeus** Merriam is large; dark above, with only a narrow white streak on belly, the sides washed with yellowish; S. Minn.

aaa. Fox Squirrels (*Guerlinguetus* Gray).

1304. **S. niger niger** Linnaeus. Fox Squirrel. Yellowish gray or rusty, mixed above with blackish, sometimes entirely black in the South; belly usually cinereus; ears rusty red, never white; nose white; tail rusty below; L. 26. T. 14. One of the largest and handsomest of squirrels. S. Va. and S. (Lat., black.) The Northern form (**S. n. neglectus** Gray), from W. Pa. to Va., is smaller, belly usually whitish, paler in color, and never black. L. 23½; T. 11. It occurs in deep woods and is nearly extinct. **S. n. bryanti** H. H. Bailey. Maryland Fox Squirrel. Large and pale; E. Md. **S. n. rufiventer** Geoffroy. More red, or clay color, varying from almost white to jet black; tail very large and bushy. Top of head always black; ears and nose white. fur coarse; feet very large. L. 24. T. 12. W. Pa. to Minn., S. in Miss. Valley to N. La.

789. GLAUCOMYS Thomas (Gr., *γλαυκός*, bluish gray, *μῦς*, mouse)

1305. **G. volans volans** (Linnaeus). Flying Squirrel. Dull yellowish brown or dark gray, creamy white below, the shade not changing in winter. L. 10. T. 4. N. H. to Ga. and Okla. Not rare in forests. (Lat., flying.)

1306. **G. sabrinus sabrinus** (Shaw). Northern Flying Squirrel. Larger. Brown or cinnamon above; dirty white below, summer pelage uniform sooty drab. L. 11. T. 5⅛. Canada from Quebec to Alberta, and N. E. Minn. (Lat., from Severn R., Canada.) The form from Nova Scotia to N. Wisc. is **G. s. macrotis** Mearns; paler and smaller. **G. s. canescens** Howell. Much paler and grayer. N. W. Minn., S. W. Manitoba, and E. N. D.

Family CCXLV. GEOMYIDAE (The Pouched Gophers)

Cheek pouches large and distinct, opening outside of the mouth. Molars $\frac{4}{4}:\frac{4}{4}$; incisors large and thick; skull heavy; temporal bones enormously developed. Limbs about equal, the fore claws 5 in number, very large; tibia and fibula united. Body thickset and clumsy. Species many, all North American, and chiefly inhabiting the central plains and W.; habits subterranean, an unqualified nuisance to the gardener, especially in Cal. In the arid West occur numerous species of *Heteromyidae* (Pocket Mice) smaller than the Gophers, and with thinner and more papery skulls.

a. Upper incisor, each with a large groove near the middle; ears rudimentary; fore claws enormous. . . . . Geomys, 790.

aa. Upper incisors not grooved; ears distinct but very small; claws moderate. Thomomys, 791.

790. GEOMYS Rafinesque (Gr., *γή*, earth; *μύs*, mouse)

1307. **G. bursarius** (Shaw). Pocket Gopher. Prairie Gopher. Reddish brown, with plumbeous tinge; upper incisors with 2 grooves, the larger near the middle line; tail and feet hairy. L. 11. T. 3. Prairies, Wisc., Ill., and W. to S. D. and Neb.; very common. (Lat., pouched.)

G. tuza

791. THOMOMYS Wied (Gr., *θομός*, heap; *μύs*, mouse)

1308. **T. talpoides rufescens** (Wied). Northern Pocket Gopher. Dusky plumbeous; tail, feet, and breast mostly white; ears in a dusky area. L. 9½. T. 2½. E. S. D. and N. W. (Lat., brownish.) Numerous other species W. of Rocky Mts.

Family CCXLVI. CASTORIDAE (The Beavers)

Aquatic rodents of large size, having the molars rootless, $\frac{4}{4}-\frac{4}{4}$; hind feet webbed; body stout and heavy; tail broad, flat, and scaly; tibia and fibula distinct; no postorbital process. A single genus now living, belonging to the Northern Hemisphere.

792. CASTOR Linnaeus (Lat., beaver)

1309. **C. canadensis canadensis** Kuhl. AMERICAN BEAVER. Reddish brown, grayish below. L. 40. T. 10. Weight 45 to 60 lb. Canada, from Hudson Bay and Labrador S. to N. N. D., Minn., and the northeastern states; once abundant, now being rapidly exterminated. (Lat., of Canada.) **C. c. carolinensis** Rhoads, occurs in S. E. U. S. **C. c. michiganensis** Bailey, the darkest form, occurs in Mich. and Wisc. **C. c. missouriensis** Bailey; smaller and paler; upper Mo. R. drainage in N. D. and W.

FAMILY CCXLVII. MURIDAE (THE MICE)

Incisors $\frac{1}{1}$; molars usually $\frac{3}{3}$ — $\frac{3}{3}$; anteorbital foramen a vertical slit, widening above and bounded externally by a broad plate of the upper maxillary; coronoid and condyloid processes of lower jaw well developed. Tibia and fibula united below. A large family, of hundreds of species found in all parts of the globe, some of the species (*Mus* and *Rattus*) being nearly cosmopolitan, having accompanied man in his migrations; all are of small size, the muskrat being one of the largest, and some are smaller than any other quadrupeds, except the Shrews. Many of the species have great economic importance because of their destruction of growing crops or stored food, or as disease carriers. Some species, more particularly the meadow mice, are more or less gregarious in habits, and often become excessively abundant.

a. Incisors broad, often broader than deep; molars rooted or rootless with flat crowns and reëntrant angles (body heavy, eyes small, snout blunt, legs short, ears small). (*Microtinae.*)
b. Tail flattened, scant-haired; hind feet partly webbed; size large, aquatic. ONDATRA, 793.
bb. Tail subterete.
c. Upper incisors grooved. . . . . SYNAPTOMYS, 794.
cc. Upper incisors not grooved.
d. Molars rootless, from persistent pulps.
e. Mammae 8; fore claws not longer than hinder. MICROTUS, 795.
ee. Mammae 4; fore claws longer than hind claws. PITYMYS, 796.
dd. Molars rooted, small and weak (back red). . . . . EVOTOMYS, 797.
ddd. Molars rooted, large and strong (back not red). . . . . PHENACOMYS, 798.
aa. Incisors narrow, compressed; molars rooted, tuberculate, with crenate margin (body slender; eyes and ears large; snout pointed).
f. Molars of upper jaw with tubercles in 2 series (American species).
g. Mouse-like. (*Cricetinae.*)
h. Upper incisors grooved. . . . . REITHRODONTOMYS, 799.
hh. Upper incisors not grooved.
i. Tail scant-haired, very long, as long as head and body; ears very small. ORYZOMYS, 800.
ii. Tail closely haired, much longer than head; ears large. . PEROMYSCUS, 801.
iii. Tail closely haired, scarcely longer than head. . . . . ONYCHOMYS, 802.
gg. Ratlike molars with reëntrant angles; length, with tail, a foot or more. (*Neotominae.*) NEOTOMA, 803.
ff. Molars of upper jaw, with tubercles in 3 series; soles naked; tail long, scant-haired or scaly; Old World species, introduced in the United States (*Murinae*).
j. Tail scaly; size large; rats. . . . . RATTUS, 805.
jj. Tail scant-haired; size small; mice. . . . . MUS, 804.

793. ONDATRA Linck
(*Fiber*, Cuvier)

1310. **O. zibethica zibethica** (Linnaeus). Muskrat. Color dark brown. L. 22½. T. 11. N. Am., almost everywhere. Largest of our *Muridae;* building houses or digging burrows about streams and ponds. Typical *zibethica* inhabits S. E. Canada and northeast. U. S., N. of Ga., except along Atlantic seaboard S. of Delaware Bay. (Lat., *zibetha*, the civet, from its musky odor.) **O. z. macrodon** (Merriam); color very much darker; teeth very much larger; otherwise like the common muskrat. S. N. J., Md., S. to N. N. C.

794. SYNAPTOMYS Baird (Gr., *συνάπτω*, to join; *μῦς*, mouse; connecting lemmings and mice)

1311. **S. cooperi cooperi** Baird. Lemming Mouse. Bog Lemming. Mouse-color, grayish below; head very large with long whiskers; fur soft and long. Mouse-like but with a very short tail; mandibular molars with closed triangles upon the outer sides, and outer reëntrant angles well developed. L. 4¾. T. ¾. S. Quebec, N. B., S. to S. N. Y., W. and N. W. to N. E. Mich., N. Wisc., and N. E. Minn. (Lat., To William Cooper.) **S. c. stonei** Rhoads, differing cranially, occurs from S. E. Mass., N. J., and Pa., W. to S. E. Wisc., and S. to Md., mountains of E. N. C., and S. Ind. **S. c. helaletes** Merriam, larger, with stouter feet, occurs in extreme S. E. Va. and N. E. N. C. **S. c. gossii** (Coues), largest, and brightest colored, occurs from E. Iowa, and S. to S. Ill. and N. E. Ark., W. to E. Kans.

1312. **S. borealis sphagnicola** Preble. Preble's Lemming Mouse. Similar in size and color to *S. c. cooperi*, less grayish on the flanks and cheeks; mandibular molars without closed triangles upon the outer sides, and practically no outer reëntrant angles. Maine, N. N. H., N. to N. B. and Quebec, E. and S. of St. Lawrence R. (Lat., dweller in sphagnum.)

795. MICROTUS Schrank (*Arvicola* Lacépède)
(Gr., *μικρός*, small; *οὖς*, ear)

a. Posterior upper molar with 1 exterior triangle and a posterior trefoil; middle upper molar with 1 internal triangle; front lower molar with 2 internal and 1 external triangle.
b. Fore claws not larger than hinder; fur coarse, not glossy; size medium.

1313. **M. ochrogaster ochrogaster** (Wagner). Prairie Meadow Mouse. Grizzly brownish, rusty plumbeous below. L. 5½. T. 1. Mich. to Kans., and S. (Gr., *ὀχρός*, brownish yellow; *γαστήρ*, belly.) **M. o. minor** (Merriam) occurs in Minn. and Dak.

aa. Posterior upper molar with 2 external triangles and a posterior crescent; middle upper molar with 2 internal triangles; front lower molar with 3 internal and 2 or 3 lateral triangles; size large.

1314. **M. pennsylvanicus pennsylvanicus** (Ord). MEADOW MOUSE. FIELD MOUSE. Fore claws not longer than hind claws. Grayish brown, blackish mesially, hoary below. L. 5½. T. 1½. E. U. S., generally abundant. (Lat., of Pennsylvania). Variable; **M. p. fontigenus** (Bangs), from localities in Canada, and **M. p. acadicus** from Nova Scotia, both smaller and paler, are recognized.

1315. **M. chrotorrhinus** (Miller). Slightly smaller than *M. pennsylvanicus* with broader hind feet; nose patch tawny ochraceous; brain case low, broad. New Brunswick and Ontario to the Catskills. (Gr., *χρόs*, color; *ρίν*, nose.)

1316. **M. breweri** (Baird). Like *M. pennsylvanicus*, or a little larger, paler, yellowish gray, below nearly white. Restricted to Muskeget Island, Mass. (Lat., To Dr. T. M. Brewer.)

796. PITYMYS McMurtrie (Gr., *πίτυs*, pine; *μῦs*, mouse)

1317. **P. pinetorum pinetorum** (Le Conte). PINE MOUSE. Chestnut-color, ashy below; small. L. 4¾. T. ⅘. Pine woods, Mass. to Ga. (Lat., of the pines.) The northern form, N. Y. to Ill., is **P. p. scalopsoides** (Audubon & Bachman). The Middle-Western form is **P. p. auricularis** Bailey; Ind. to Miss. Both of these subspecies are larger and darker than the Georgia form (*pinetorum*). **P. p. nemoralis** (Bailey), duller than *pinetorum*, but paler than *scalopsoides* or *auricularis*, occurs W. of Miss. R., from Ark. N. to Iowa.

Clethrionomys

797. ~~EVOTOMYS~~ Coues (Gr. *ἐυ*, well; *οῦs*, ear; *μῦs*, mouse)

1318. **E. gapperi gapperi** (Vigors). RED-BACKED MOUSE. RED-BACKED VOLE. Two color types, the red and the dusky. Median line of back typically bright chestnut, sides buffy-yellowish; belly pale buffy white; the general hue sometimes dusky; fur full and soft. L. 4½. T. 1⅛, scarcely more than twice hind foot. Mass. to Pa. and N. (Lat., To Dr. Anthony Gapper, who collected in Ontario about 1830.) **E. g. rhoadsii** Stone; tail distinctly bicolor, less than twice length of hind foot; dorsal stripe indistinct plain chestnut. N. J. and Hudson highlands. **E. g. loringi** Bailey; smallest of the genus; dorsal stripe dark rich chestnut. Minn., Dak.

1319. **E. carolinensis** Merriam. Larger than *E. gapperi;* color darker, rich chestnut above, everywhere with black hairs. L. 6. T. 1¾. W. Va., and S. (Lat. of Carolina.)

798. PHENACOMYS Merriam (Gr., *φέναξ*, a cheat; *μῦs*, mouse)

1320. **P. ungava ungava** Merriam. FALSE LEMMING MOUSE. Molars distinctly 2-rooted in adult. Reëntrant angles on inner side of lower molars very much deeper than those of outer side, not approximately equal to outer angles as in *Microtus* and *Evotomys*. Dull rusty brown, whitish below, tail bicolor. L. 4⅗. T. 1⅛. Labrador, S. to W. Ontario. (Lat., of Ungava.)

799. REITHRODONTOMYS Giglioli (Gr., *ῥεῖθρον*, channel; *ὀδών*, tooth; *μῦς*, mouse)

1321. **R. humulis humulis** (Audubon & Bachman). Little Harvest Mouse. Dark brown, washed with cinnamon, lateral band obsolete; dingy gray or yellowish below. L. 4¾. T. 2¼. E. ⅓. Smallest of our mice, the fur soft and silky. South Atlantic States, N. to Va. (Lat., *humulis*, on the ground; i.e., low or small.) **R. h. impiger** Bangs, in Va. and W. Va.; smaller, with smaller ears, the color richer brown; rather common about White Sulphur Springs, W. Va.

1322. **R. megalotis dychei** Allen. Western Harvest Mouse. Dark fulvous gray above, lined with black; sides with faint fulvous band; L. 5⅛. T. 2⅔. E. ⅔. Kans., Neb., E. to St. Louis. (Lat., for L. L. Dyche.)

800. ORYZOMYS Baird (Gr., *ὄρυζα*, rice; *μῦς*, mouse)

1323. **O. palustris palustris** (Harlan). Rice-field Mouse. Blackish and ashy above, becoming paler below; fur harsh, but compact; soles perfectly naked. A large, rat-like species. L. 8. T. 4. N. J. to S. E. Mo. and S. (Lat., *palus*, marsh.) **O. p. texensis** Allen, Kans., S. E. Mo., and S.

801. PEROMYSCUS Gloger (*Hesperomys* Waterhouse) (Gr., *πήρα*, pouch; *μῦς*, mouse)

~~a. Mammae 6; plantar tubercles 6.~~
~~b.~~ Tail distinctly 2-colored.
c. Tail ~~shorter~~ than rest of body.

1324. **P. maniculatus borealis** Mearns. Deer Mouse. Color brownish, with a sooty stripe along the back; belly white; feet not quite white; hind feet less than ¾ inch. L. 5. T. 1½. E. Man., S. to L. Superior, E. to Quebec, in forests. (Lat., boreal.) **P. m. gracilis** Le Conte, with longer tail, the common form from S. Que. and Vt. to Minn.; **P. m. abietorum** Bangs, fir forests of Nova Scotia and Maine; **P. m. nubiterrae** Rhoads, a smaller form, S. Alleghenies; and **P. m. bairdi** Hoy and Kennicott, very dark, with shorter tail, the common prairie form.

~~bb.~~ Tail ~~not 2-colored, not~~ shorter than rest of body.
d. General color brownish, without reddish or orange shades.

1325. **P. leucopus leucopus** (Rafinesque). White-footed Mouse. Deer Mouse. Wood Mouse. Color yellowish brown or fawn color; belly and feet pure white; tail always bicolor; hind feet more than ¾ inch. L. 6½. T. 3¼. Woodlands and fields, S. Va. and N. C., S. to La., W. to Okla.; everywhere common. (Gr., *λευκός*, white; *ποῦς*, foot.) The northern form, **P. l. novaeboracensis** Fischer, averaging larger, ranges from Nova Scotia to Kans. **P. l. ammodytes** Bangs is restricted to Monomoy I., near Cape Cod; and **P. l. fusus** Bangs, to Marthas Vineyard.

dd. Color cinnamon or dull orange, with reddish shades.

1326. **P. nuttalli nuttalli** (Harlan). GOLDEN MOUSE. Golden cinnamon, bright on ears; belly not pure white; tail unicolor. L. 6. T. 2½. N. C., S. Ga., W. and N. to S. E. Mo. and N. E. Ark., scarce. (To Thomas Nuttall.) **P. n. aureolus**; smaller; S. Va. to Ky. and N. E. Ala.

1327. **P. gossypinus gossypinus** (Le Conte). COTTON MOUSE. Large, rusty brown, with a darker wash along back; below ashy. L. 6½. T. 2½. Cotton fields, from Dismal Swamp to La. (Lat., *gossypium*, cotton.)

802. ONYCHOMYS Baird (Gr., ὄνυξ, claw; μῦς, mouse)

1328. **O. leucogaster leucogaster** (Wied). GRASSHOPPER MOUSE. Mouse-gray; snow white below; ears high, furry. L. 5⅓. T. 1⅓. W. Minn., S. Man. to northeast. S. D., common W.; with many variants. (Gr., λευκός, white; γαστήρ, belly.)

803. NEOTOMA Say and Ord (Gr., νέος, new; τομός, cutting; i.e., rodent)

1329. **N. floridana illinoensis** Howell. ILLINOIS WOOD RAT. Brown to grayish brown; underparts creamy white; tail scant-haired, nearly concolor, L. 12. T. 5. S. Ill. to N. E. Ark. (Lat., of Illinois.) **N. f. attwateri** Mearns; smaller, tail shorter; ranges from S. W. Mo. and N. W. Ark. S. W.

1330. **N. pennsylvanica** Stone. EASTERN WOOD RAT. Brownish gray, the sides tawny; belly and feet entirely white; tail well-haired, bicolored. L. 13. T. 5. S. N. Y. to N. Alabama, rare and local.

NOTE. Old World forms of *Muridae* are the two following genera, now only too well established in America:

804. MUS Linnaeus

1331. *M. musculus* Linnaeus. HOUSE MOUSE. Originally native of Southern Asia; now nearly cosmopolitan in temperate and tropical regions, coming to this country on ships.

805. RATTUS Fischer

1332. *R. rattus rattus* (Linnaeus). BLACK RAT. Tail not shorter than rest of body; color black; plumbeous below; feet brown. Introduced in 1754, but now nearly exterminated by the Norway Rat, *R. norvegicus*. *R. r. alexandrinus* (Geoffroy St. Hilaire). ROOF RAT. WHITE-BELLIED RAT. Tail as in *R. r. rattus;* color gray above; whitish below. Introduced later from Egypt. Southern states.

1333. *R. norvegicus* (Erxleben). COMMON RAT. WHARF RAT. NORWAY RAT. BROWN RAT. Tail nearly an inch shorter than rest of body. Grayish brown, paler below, fur with stiff hairs intermixed. Widely distributed, introduced into America about 1775; now a world pest, especially as a bearer of plagues, transferred by fleas to other rodents and to men. (*R. decumanus* Pallas.)

Family CCXLVIII. ZAPODIDAE (The Jumping Mice)

Hind legs greatly elongated, adapted for taking long leaps; fore legs short. Tail very long. Molars $\frac{4}{5}:\frac{4}{3}$ or $\frac{3}{5}:\frac{3}{4}$; upper incisors compressed, grooved; molars rooted; internal cheek pouches present; toes 5–5; tibia and fibula united. Species numerous; chiefly American.

a. Premolar single; very small. . . . . Zapus, 806
aa. Premolar wanting. . . . . Napaeozapus, 807

806. ZAPUS Coues (Gr., ζά, an intensive particle; πούς, foot)

1334. **Z. hudsonius** (Zimmermann). Jumping Mouse. Yellowish brown; fur coarse and rough; tip of tail dark; soles naked. Molars $\frac{4}{3}:\frac{4}{3}$. L. 8. T. 5. Ear $\frac{4}{5}$. U. S., chiefly N. (Lat., of Hudson [Bay].) The more common form S. E. is **Z. h. americanus** (Barton), N. C. to Conn. **Z. h. ladas** Bangs, larger and darker, occurs in E. Quebec.

807. NAPAEOZAPUS Preble (Gr., ναπαῖος, living in a woodland glade; *Zapus*)

1335. **N. insignis insignis** (Miller). Woodland Jumping Mouse. Larger than *Z. hudsonius*, with longer ears and paler, more fulvous coloration, tail with white tip; molars $\frac{3}{3}:\frac{3}{3}$. L. 10. T. 6. In deep woods, N. S., Me. to W. Md.; rare. (Lat., distinguished.) **N. i. abietorum** (Preble), L. Superior E. to Nova Scotia. **N. i. frutectanus** Jackson, N. Wisc.

Family CCXLIX. ERETHIZONTIDAE (The American Porcupines)

Molar teeth $\frac{4}{4}$ on each side; fur more or less mixed with bristly, barbed spines; tip of muzzle with small hair; tibia and fibula distinct. Genera 3, all American. The American Porcupines differ in many respects from the Old World Porcupines (*Hystricidae*). The former are chiefly arboreal, the latter terrestrial. Allied to this family in the South American group of *Cavidae*, represented by the Guinea (Guiana) Pig (*Cavia cobaya*).

a. Tail short, thick, not prehensile; claws $\frac{1}{2}$, long, compressed, and curved; nostrils close together. . . . . Erethizon, 808.

808. ERETHIZON Frédéric Cuvier (Gr., ἐρεθίζω, to irritate)

1336. **E. dorsatum** (Linnaeus). Canada Porcupine. Dark brown, spines tipped with yellowish white, and 4 to 6 inches long. L. 40. T. 6. E. N. Am., S. to Me., and, along the higher mountains, to Pa.; formerly common in a much wider range. (Lat., *dorsum*, back.)

Order: Lagomorpha

Family CCL. LEPORIDAE (The Hares)

Incisors $\frac{4}{2}$, the extra pair in upper jaw small, and placed behind the principal pair, which are grooved in front; molars $\frac{6}{6}:\frac{6}{6}$; the teeth 28 in all; tail short, bushy, recurved; eyes large; ears long; soles furred. Widely distributed, with many species and subspecies, among them the familiar Rabbit (*Lepus cuniculus* L.) of Europe, and several native species commonly called rabbits, but more properly hares, as that word is used in England.

a. Species of large size, the ears and hind legs very long; anterior ribs, (3 to 5) broad and flattened (Jack Rabbits and "Snowshoe Rabbits"). . . . . Lepus, 809.

aa. Species of smaller size, the ears and hind legs comparatively short; anterior ribs slender; fur not white in winter (Cottontails and Swamp Rabbits). . . . Sylvilagus, 810.

809. LEPUS Linnaeus (Lat., a hare)

1337. **L. americanus americanus** Erxleben. Varying Hare. Snowshoe Rabbit. White Hare. Ears about as long as head; fur in summer cinnamon brown; in winter becoming white at the surface, plumbeous at base, with a median band of reddish brown. L. 20. T. $2\frac{1}{3}$. Ear 3. In evergreen woods, E. and N. The typical *americanus*, with ears white-edged, is found from Alberta to Quebec and S. to Ontario, and N. E. Mich. (Lat., of America.) **L. a. virginianus** (Harlan), the common form in E. U. S., in pine, fir, and hemlock forests, Ontario and Maine, S. along the Alleghenies to W. Va., has the white border of ear small or wanting, the median brown band broad. **L. a. struthopus** Bangs, from Nova Scotia, similar to typical *virginianus*, but having the hind foot much smaller; color in summer pelage darker and duller. **L. a. phaeonotus** Allen; buff color, smaller; Wisc., N. W. Mich. and N. Minn.

1338. **L. townsendii campanius** Hollister. White-tailed Jack Rabbit. Prairie Hare. Ears much longer than head. Fur pale yellowish gray in summer, in winter white at surface and base, yellowish in middle; tail long, all white. L. 23. T. $3\frac{1}{2}$. Ear 5. Kans. and Minn., to Mont. (Lat., *campanius*, of the field.) Replaced in California and S. E. by the common Jack Rabbit, **L. californicus** Gray (subgenus *Boreolepus* Barrett-Hamilton). This form runs into several subspecies.

810. SYLVILAGUS Gray (Lat., *sylva*, forest; Gr., λάγως, rabbit)

a. "Cottontails," not inhabiting marshes; tail white, loosely haired.

1339. **S. floridanus mallurus** Thomas. Cottontail. Gray Rabbit. Tail cottony white, conspicuous; ears $\frac{2}{3}$ length of head. Gray above, varied with dark and tinged with yellowish brown; white below; not becoming white in winter. L. 18. T. 2. Ear $2\frac{1}{4}$. E. U. S., N. to N. Y.; abundant. (Gr., μαλλωτός, wooly.) **S. f. mearnsi** Allen is paler, the ears shorter; S. W.

N. Y. to N. E. Kans. S. f. alacer (Bangs) is smaller, more reddish; W. Kentucky, Tenn., S. Mo., S. to Gulf of Mex.

1340. S. transitionalis (Bangs). Smaller, a black spot between the ears. New England and S. (Lat., of transition [zone].)

aa. Marsh rabbits, the tail short, densely haired, not fully white.

1341. S. palustris palustris (Bachman). Marsh Rabbit. Width of skull half its length. Yellowish brown; tail grayish, not cottony. L. 17. T. 1. Ear 2½. S. E. Va. to S. Ill. and S., in swamps. (Lat., of the marsh.)

1342. S. aquaticus (Bachman). Swamp Rabbit. Width of skull not half its length. Yellowish brown, white below; tail white below, as in the Cottontail (*S. f. mallurus*). L. 22. T. 2. Ear 3. S. Ill. to La. and S. W., in canebrakes and about lowland streams. (Lat., aquatic.)

" We have reached the end of the chain of rodent beings of the earth, the water, and almost of the air, — a cycle of mammalian life which circumscribes extraordinary diversity of form and function, revolving about a single central point of organization; namely, adze-like teeth, to gnaw wood with. The number of individuals which make a living in this way in a world of Malthusian strife is simply incalculable. . . . Yet they have one obvious part to play, that of turning grass into flesh, in order that carnivorous Goths and Vandals may subsist also, and in their turn proclaim, ' All flesh is grass.' " (*Coues.*)

Order LXII. ARTIODACTYLA (The Even-toed Ungulates)

Herbivorous mammals provided with 2 to 4 enlarged and thickened hoofs on each foot; molar teeth adapted for grinding. The characters of the well-known and varied group Ungulates are too numerous to be here summarized. It is usually subdivided into the *Perissodactyla*, or odd-toed ungulates, and the *Artiodactyla*, or even-toes. The former order is exemplified by the Horse (*Equus caballus* L.), the Ass (*Asinus asinus* L.), and the Rhinoceros. The *Artiodactyla* are again subdivided into the non-ruminating, omnivorous, hornless, naked, or bristly allies of the Common Hog and Wild Boar (*Sus scrofa*), and the group of *Pecora* (Ruminants). To the latter belong all the living ungulates occurring within our limits. (Lat., *ungulatus*, hoofed.)

Families of Artiodactyla

a. Feet cloven; 1st toe wanting; 2d and 4th rudimentary. (*Artiodactyla.*)
  b. Stomach compound, of 3 or 4 compartments; horns usually present at least in males. (*Pecora.*)
    c. Upper jaw without incisors, in the adult.
      d. Horns solid, usually branching, deciduous. . . . . Cervidae, CCLI.
      dd. Horns hollow at base, branched, deciduous. . . . . Antilocapridae, CCLII.
      ddd. Horns permanent, hollow, each enclosing a process of the frontal bone. Bovidae, CCLIII.

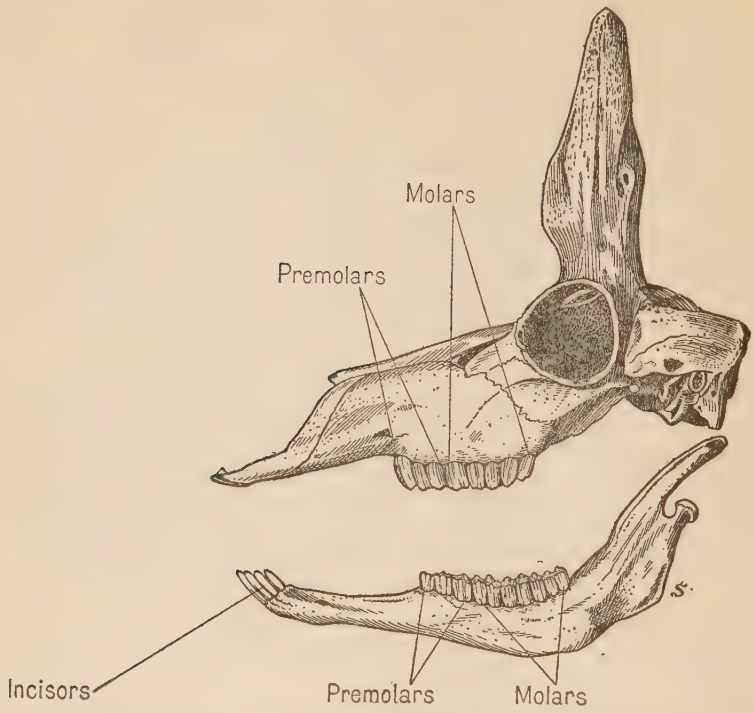


Fig. 14. Skull of an Antelope (*Antilocapra*), showing the arrangement of teeth characteristic of the order *Artiodactyla*. In this order the premolars and molars are adapted to grinding; the canines are often absent; and in some families, as the deer and pronghorns, for example, the upper incisors are also absent.

Family CCLI. **CERVIDAE** (The Deer)

Horns deciduous, solid, developed from the frontal bone, more or less branched, covered at first by a soft, hairy integument, known as "velvet"; when the horns attain their full size, which they do in a very short time, there arises at the base of each a ring of tubercles known as the "burr"; this compresses and finally obliterates the blood vessels supplying the velvet, which dries up and is stripped off, leaving the bone hard and insensible; the horns or "antlers" are shed annually, the separation of the "beam" from its "pedicel" taking place just below the burr; antlers are wanting in the female (excepting in the Reindeer), but they are present in the male of nearly all species. Stomach in 4 divisions, of the ordinary ruminant pattern. Dental

formula, i. $\frac{0}{3}-\frac{0}{3}$; c. (usually) $\frac{0}{1}-\frac{0}{1}$; pm. $\frac{3}{3}-\frac{3}{3}$; m. $\frac{3}{3}-\frac{3}{3}$. A widely distributed family of several genera.

a. Horns present in males only.
b. Horns rounded more or less; rarely sub-palmated; nose naked and moist.
c. Horns small, curving forward, the first snag short, at some distance above the base, and like the others curving upward; tail rather long; hoofs rather elongate. ODOCOILEUS, 811.
cc. Horns large, curving backward, with the snags all directed forward, one of them immediately above the burr; tail very short; hoofs broad and rounded. CERVUS, 812.
bb. Horns very broadly palmated to the tip; nose very broad, entirely hairy except a small naked spot between nostrils. . . . . ALCES, 813.
aa. Horns (present in both sexes) broadly palmated at tip; nose entirely hairy. RANGIFER, 814.

811. ODOCOILEUS Rafinesque (Gr., ὀδούς, tooth; κοῖλος, hollow)

1343. O. **virginianus virginianus** (Boddaert). WHITE-TAILED DEER. VIRGINIA DEER. General color chestnut red, grayish in winter; tail white below. Md. to Great Plains and S. to N. Fla.; formerly very common, and still abundant in wild districts. (Lat., Virginia.) **O. v. macrourus** (Rafinesque); yellowish gray, waved with dusky; lower side of tail, etc., white; chin mostly white; size of preceding; Dak. to Texas and W. Represented in Maine and W. by **O. v. borealis** Miller; paler and larger.

1344. O. **hemionus hemionus** Rafinesque. MULE DEER. Larger; ears very long, nearly as long as tail. Ashy brown, a darker dorsal stripe. N. W. Minn. and to Ore. and S. W. (Gr., ἥμι, half; ὄνος, ass or mule.)

812. CERVUS Linnaeus (Lat., stag)

1345. C. **canadensis canadensis** (Erxleben). AMERICAN "ELK." WAPITI. Chestnut red, grayish in winter; size nearly equal to that of the Moose. Formerly N. Y. to Wisc., Wyo. and W., S. to Tenn.; now becoming rare, extinct eastward. Commonly and wrongly called "Elk" in America. A noble animal, related to the great Stag of Europe, *Cervus elaphus* Linnaeus, the "Tall Deer," beloved of England's sportsman-kings.

813. ALCES Gray (Gr., ἄλκη, elk)

1346. A. **americanus americanus** (Clinton). MOOSE. (TRUE ELK.) Tawny above, yellowish below; ears large; profile of snout very convex. Largest of our *Cervidae*, and one of the noblest of animals, reaching the size of a horse. Me. and N. B. to Wash. and N.; becoming rare in E. U. S. Closely related to the European Elk, *A. alces* (Linnaeus). (Lat., America.)

814. RANGIFER Hamilton Smith (old name from French, *rangier*)

1347. **R. caribou caribou** (Gmelin). Woodland Caribou. American Reindeer. Brownish, grayer in winter. N. S. to L. Superior and N. E. (Caribou, the French name in Canada.) **R. c. sylvestris** (Richardson) is found S. W. of Hudson Bay. The species is allied to the European Reindeer, *R. tarandus* (Linnaeus).

Family CCLII. ANTILOCAPRIDAE (The Pronghorns)

This group contains a single species, intermediate between the *Cervidae* and the *Bovidae*. With the characters of some *Bovidae*, its horns are branched and the sheath deciduous. Horns erect, compressed at base, with a short branch or flattened process in front, the end conical, recurved; both sexes with horns, which in the female are smaller; nose hairy at tip except along median line; tail very short; no false hoofs. One species, a singular, antelope-like animal of the Rocky Mountains region, but not really related to the true or African antelopes. It is the only hollow-horned animal in which the horns are shed. It once ranged in thousands from California to Iowa, and from Canada to Mexico. Out of the millions that formerly roamed the plains, it is estimated that about 26,000 animals in the U. S., with perhaps 4000 more in Canada and Mexico, now remain.

815. ANTILOCAPRA Ord (Gr., *ἀνθόλοψ*, antelope; Lat., *capra*, goat)

1348. **A. americana americana** (Ord.). Pronghorn. Cabree. Berendo. Rocky Mountain "Antelope." Yellowish brown, marked with brown and white. L. about 5 feet. T. 7 inches. Height 3 feet. Mont. to Tex., S. and W.; formerly very abundant, now approaching extinction. (Lat., America.)

Family CCLIII. BOVIDAE (The Cattle)

Ruminants with the horns, if present, simple, hollow, permanent, each enclosing a process of the frontal bone. Teeth i. $\frac{3-3}{3-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{4-4}$; m. $\frac{2-2}{2-2}$ = 32. Species 100 or more, inhabiting warm regions, and most abundant in the Old World. The Ox (*Bos taurus* Linnaeus), the Sheep (*Ovis aries*), and the Goat (*Capra hircus*) are familiar members of the family. The Bighorn, *Ovis canadensis* Shaw, occurs to the westward of our limits, as also the Rocky Mountain Goats, *Oreamnos americanus* (Blainville), one of the most attractive of wild animals, but now disappearing.

a. Nose naked at tip and very broad; horn curved, the base directed outwards; hoofs broad; tail long; forehead broader than long. (*Bovinae.*)
b. Body highest at shoulders; anterior parts with a long, shaggy mane. . . Bison, 816.

816. BISON Hamilton Smith (Lat., buffalo)

1349. **B. bison** (Linnaeus). Bison. American Buffalo. Brown; the snout, hoofs, and horns, black. U. S. generally; formerly very abundant, but now almost extinct, except for a few small herds in semi-domestication. This is quite distinct from the European ox-like animal, known as Buffalo, which is much smaller. (Lat., buffalo.)

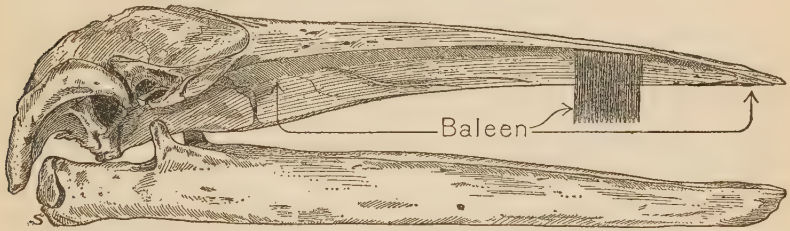


Fig. 15. Skull of a Whale (*Balaenoptera*), showing a few of the baleen plates, or whalebone. These baleen plates are found only in those families of *Cetacea* that do not possess teeth, either rudimentary or functional.

Order LXIII. CETACEA (The Cetaceans)

Mammals of the sea, more or less fish-like in form, and adapted for life in the open ocean. Bones of the neck short, more or less fused; posterior limbs wanting; pelvis rudimentary; anterior limbs developed as broad, flattened paddles, without distinct fingers and without nails. Nostrils developed as spiracles, and opening usually on top of head, thus enabling the animals to breathe without raising the head from the water; eyes small; no external ear; skin nearly or quite destitute of hair; tail ending in a broad horizontal fin or paddle; back sometimes with a dorsal fin. Skin thick and tough; beneath it a thick layer of fat (blubber), which protects the animal from the cold. Species numerous; found in all seas, some of them being the largest of all living animals. Of the species occasionally straying to our coasts, the following seem properly to belong to our fauna. (Gr., κήτη, whale.)

Families of Cetacea

a. Upper jaw without whalebone; spiracles coalescent into one; lower jaw much less thick than upper; skull unsymmetrical. (*Odontoceti.*)
b. Upper jaw with teeth (except in the adult of one genus); eye inserted behind angle of mouth and not much above it; snout more or less sharp at tip; lower jaw with numerous (6 to 120) teeth. . . . . Delphinidae, CCLIV.

bb. Upper jaw toothless; eye decidedly above angle of mouth.
c. Lower jaw with 2 to 4 teeth, or apparently toothless; snout more or less broadened or sharp at tip. . . . . ZIPHIIDAE, CCLV.
cc. Lower jaw with 18 to 50 teeth; snout not sharp, sometimes truncate at tip. PHYSETERIDAE, CCLVI.
aa. Upper jaw with long strips of baleen or whalebone; no teeth; spiracles separate; eye very small, close to angle of mouth, between mouth and pectorals; lower jaw very thick and deep, nearly as deep as upper, the cleft of mouth curved. (*Mysticeti.*)
d. Belly with longitudinal folds; dorsal fin present or absent; whalebone strips moderate. BALAENOPTERIDAE, CCLVII.
dd. Belly without folds, dorsal fin wanting; whalebone strips very large, black. BALAENIDAE, CCLVIII.

FAMILY CCLIV. DELPHINIDAE (THE DOLPHINS)

Cetaceans with well-developed teeth in both jaws (deciduous in the upper jaw in one genus); a single, somewhat complicated nasal tube. Species numerous, including the smaller and many of the most active and voracious of the *Cetacea*.

a. Head with an elongate beak; a distinct dorsal fin.
b. Teeth in each jaw about 44; truncate at tip; palate without lateral grooves. TURSIOPS, 817.
bb. Teeth in each jaw 80 to 120.
c. Palate without lateral grooves. . . . . PRODELPHINUS, 818.
cc. Palate with deep lateral grooves. . . . . DELPHINUS, 819.
aa. Head with a very short beak or none; dorsal present or absent.
d. Teeth in both jaws persistent.
e. Teeth flattened; dorsal present. . . . . PHOCAENA, 820.
ee. Teeth terete.
f. Dorsal fin well developed.
g. Teeth in each jaw 44 to 46; dorsal fin falcate. . . . LAGENORHYNCHUS, 821.
gg. Teeth in each jaw 16 to 24.
h. Dorsal moderate; head almost globular; pectoral long and narrow; teeth rather weak, none in corner of mouth. . . . . GLOBICEPHALA, 822.
hh. Dorsal very high, falcate, its height greater than length of pectorals; teeth very strong; skull massive. . . . . ORCINUS, 823.
ff. Dorsal fin obsolete; pectoral short; teeth few. . . . . DELPHINAPTERUS, 824.
dd. Teeth in upper jaw feeble, disappearing with age; 6 to 14 bluntish teeth in lower jaw; dorsal fin low, rather posterior. . . . . GRAMPUS, 825.

817. TURSIOPS Gervais (Lat., *tursio*, a porpoise; Gr., ὤψ, appearance)

1350. T. truncatus (Montague). BOTTLE-NOSED DOLPHIN. Gray above, pure white below; beak short and stout; teeth $\frac{44}{44}$. Vertebrae 7 + 18 + 37. L. 11 feet. N. Atl.; common S. to Texas; caught in numbers at Cape May. (*Eu.*) (Lat., truncate.)

818. PRODELPHINUS Gervais (Gr., πρό, before; *Delphinus*)

1351. P. plagiodon (Cope). SPOTTED DOLPHIN. Form of *Delphinus delphis*. Dorsal high, recurved; arm broad; beak stout. Dark purplish slate-color above, white below; back and fins spotted with pale; lower parts spotted with dark slate. L. 10 feet. N. Atl., S. to N. J. (Gr., πλαγιός, oblique; ὀδών, tooth.)

819. DELPHINUS[1] Linnaeus (Gr., δελφίς, dolphin)

1352. **D. delphis** Linnaeus. Dolphin. Snout narrow, sharp; occiput short, rounded. L. 10 feet. N. Atl., scarce on our coast. (*Eu.*) (Lat., dolphin.)

820. PHOCAENA Desmarest (Gr., φώκαινα, porpoise, from φώκη, seal)

1353. **P. phocoena** (Linnaeus). Harbor Porpoise. Puffing Pig. Snuffer. Color nearly plain dusky above, paler below. L. 5 feet. N. Atl. and N. Pac.; common in surf and near shore, ascending rivers. (Lat., porpoise.) (*Eu.*)

821. LAGENORHYNCHUS Gray (Gr.,λάγηνος, flask; ῥύγχος, snout)

1354. **L. acutus** (Gray). Skunk Porpoise. Bay Porpoise. Sides with broad stripes of white and yellow. L. 10 to 15 feet. Coast of N. E. U. S., and in the open seas in large schools; like other porpoises, often swimming alongside of ships as if racing with them. Common, used for bait. Two or three other species occur in the N. Atl. (*Eu.*) (Lat., pointed.)

822. GLOBICEPHALA Lesson (Lat., *globus*, globe; Gr., κεφαλή, head)

1355. **G. melaena** (Traill). Blackfish. Pilot Whale. Black; arm about 4 in length. L. 20 feet. N. Atl.; common, in large schools, S. to N. J. (*Eu.*) (Gr., μελάς, black)

1356. **G. brachyptera** (Cope). Black; arm 6 in length. Coast of N. J. and S. (Gr., βραχύς, short; πτερόν, fin.)

823. ORCINUS Fitzinger (*Orca* Gray, name preoccupied) (Lat., *orca*, a kind of whale)

1357. **O. orca** (Linnaeus). Atlantic Killer. Black, white below. A most persistently voracious and destructive cetacean, attacking all large sea animals, tunnies, swordfishes, seals, and whales, even the largest, often to the great annoyance of fishermen. L. 20 feet or more. Dorsal 6 feet high. Atl. Ocean, represented in the Pacific by *O. rectipinna* (Cope). (Lat., *orca*, some kind of whale.)

824. DELPHINAPTERUS Lacépède (Gr., δέλφις, dolphin; ἄπτερον, without fin)

1358. **D. leucas** (Pallas). White Whale. Beluga. Creamy white; young dusky. L. 15 feet. N. Atl., S. to Cape Cod. (*Eu.*) (Gr., λευκός, white.)

[1] This is the true dolphin, not to be confounded with the fish, called dolphin, which is the Dorado or Golden Dolphin, *Coryphaena*.

825. GRAMPUS Gray (name a corruption of the French "grand poisson")

1359. **G. griseus** (Cuvier). Grampus. Cowfish. Slate color, with white scratches. L. 15 to 20 feet. N. Atl.; not rare. (*Eu.*) (Lat., gray.)

Family CCLV. ZIPHIIDAE (The Beaked Whales)

This group is distinguished from the Sperm Whales chiefly by the very small number of teeth, usually not more than 4, developed in the lower jaw and fitting into pits in the upper; these teeth mostly occur only in the male. Dorsal small, posterior; pectoral short, ovate, placed low, with 5 fingers enclosed in thick skin; snout more or less produced, the forehead rising abruptly in the adult. Species few; and rare, mostly of the Southern seas.

a. Teeth in male evident.
b. Visible teeth 2, in tip of lower jaw. . . . . Ziphius, 826.
bb. Visible teeth 2, inside of lower jaw. . . . . Mesoplodon, 827.
aa. Teeth in both jaws wanting or concealed; snout elongate. . . . . Hyperoödon, 828.

826. ZIPHIUS Cuvier (An old name, from Gr., *ξίφος*, sword)

1360. **Z. cavirostris** G. Cuvier. L. 20 feet. Atl.; widely distributed, but not common. (*Eu.*) (Lat., concave snout.)

827. MESOPLODON Gervais (Gr., *μέσος*, middle; *ὅπλον*, armature; *ὀδών*, tooth)

1361. **M. bidens** (Sowerby). Cowfish. L. 20 feet. N. Atl.; scarce. S. to Nantucket. (*Eu.*) (Lat., two toothed.)

1362. **M. densirostris** (Blainville). A species of the Indian Ocean, reported from Mass. and N. J. (Lat., heavy rostrum.)

828. HYPEROÖDON Lacépède (Gr., *ὑπερῴα*, palate; *ὀδών*, tooth)

1363. **H. ampullatus** (Forster). Bottle-nosed Whale. Sperm-whale Porpoise. Beak distinct in young, obscured in adult by the development of bony crests which give the head the shape of a box. L. 25 feet. N. Atl. (*Eu.*) (Lat., *ampulla*, a box.)

Family CCLVI. PHYSETERIDAE (The Sperm Whales)

Teeth numerous, in lower jaw only; lower jaw very thin and flat; upper jaw heavy; eye placed high, much above angle of mouth. Species few, ranging widely in warm seas.

a. Dorsal fin present, behind middle of back; teeth 18 to 30, very sharp; head bluntish but not truncate; spiracles on top of head; length about 20 feet. . . . . Kogia, 829.
aa. Dorsal fin wanting; teeth 40 to 50, large and blunt; head very long and deep, truncate in front, the cavity of the snout filled with oil or spermaceti; spiracles in front of head; length 60 to 80 feet. . . . . Physeter, 830.

829. KOGIA Gray (a barbarous and unmeaning name.)

1364. **K. breviceps** (Blainville). Pigmy Sperm Whale. L. 10 feet. Warm seas, occasional on our coast. (*Eu.*) (Lat., short-headed.)

830. PHYSETER Linnaeus (Gr., φυσητήρ, a whale, from φυσάω, to blow)

1365. **P. catodon** Linnaeus. Sperm Whale. Cachalot. Blackish, paler below. Open seas, commonest far S., N. to Norway; one of the most valuable of the whales. L. ♂ 80 feet; ♀ much smaller. (*Eu.*) (Gr., κάτα, below, ὀδών, tooth.)

Family CCLVII. BALAENOPTERIDAE (Fin-back Whales)

Dorsal fins present or absent; teeth disappearing before birth, their place taken in the upper jaw by an array of parallel plates with fringed edges, known as baleen or whalebone; in this family the whalebone plates are relatively small. Eye very small, placed close to angle of mouth. Spiracles separate, comparatively simple in structure. Lower jaw very large and thick, its edge convex upward; belly with conspicuous lengthwise furrows. Huge creatures, mostly of the colder seas, feeding chiefly on small animals and sought by man for the sake of the oil obtained from the blubber.

a. Dorsal fin present; body rather elongate; pectoral fin moderate, shorter than head. (*Balaenopterinae.*)
b. Dorsal fin median. . . . . Balaenoptera, 831.
bb. Dorsal fin far back. . . . . Sibbaldus, 832.
aa. Dorsal fin wanting; body short and deep; back with a fleshy hump; pectoral fins very long, as long as head. (*Megapterinae.*) . . . . . Megaptera, 833.

831. BALAENOPTERA Lacépède (Lat., *balaena*, from Gr., φάλαινα, whale; πτερόν, fin; i.e., fin whale.)

1366. **B. physalus** (Linnaeus). Rorqual. Finner. Finback. Razorback. Grayish slate above, paler below; whalebone slate-color, varied with brownish; L. 70 feet. N. Atl. The commonest finback whale, feeding on herring. (*Eu.*) (Gr., φύσαλος, rorqual whale.)

1367. **B. borealis** Lesson. Pollack Whale. Blue-black, with oblong pale spots; flippers small, 11 in body; whalebone dark. L. 50 feet. N. Atl., occasional off our coasts. (*Eu.*) (Lat., boreal.)

1368. **B. acutorostrata** Lacépède. Little Piked Whale; Scrag Whale. Grayish black, white below; flippers with a broad white band; whalebone pale. L. 30 feet. N. Atl., occasional off our coasts. (*Eu.*) (Lat., pointed rostrum.)

832. SIBBALDUS Gray (for Robert Sibbald, 1684, author of "Scotia Illustrata")

1369. **S. musculus** (Linnaeus). Blue Whale. Sulphur-bottom Whale. Body slender; dark bluish gray, with small pale spots on breast. Whalebone black; flippers long, 7 in body; dorsal small; far back. L. 80 to 100 feet; one of the largest of animals, second only to *Sibbaldus sulfureus*, of the Pacific, which reaches 100 feet or more. North Atlantic, rarely S. Much sought for its oil. (*Musculus*, old name of some whale.)

833. MEGAPTERA Gray (Gr., μεγάς, large; πτερόν, fin)

1370. **M. nodosa** (Bonnaterre). Humpback Whale. Color mostly black. Body short and thick, with anterior hump and protuberances, the skin often covered with barnacles. Dorsal fin moderate, behind middle of body; pectoral fin very long, nearly $\frac{1}{5}$ length of body. L. 75. One of the largest whales, formerly common in the North Atlantic. "Smites its own sides, with prodigious noise, by its huge pectoral fins." (C. H. Gilbert.) Valued for its oil. (*Eu.*) (Lat., knotty.) In the N. Pac. is a closely related species, *M. versabilis* Cope.

Family CCLVIII. BALAENIDAE (The Right Whales)

Large whales without dorsal fin or ventral furrows; teeth obsolete in the adult; the whalebone plates very large. Eye small; spiracles small; lower jaw large and thick, its outline convex. Size very large. Arctic seas. Highly valued for both whalebone and blubber.

834. EUBALAENA Gray. (Gr., εὖ, typical; *balaena.*)

1371. **E. glacialis** Bonnaterre. Right Whale. Black Whale. The common large whale of our Northeastern coast and across the Atlantic to Northern Europe, occasionally S. to S. C. Color black. Whalebone black. Length 40 feet. (*Eu.*) (Lat., icy.)

835. BALAENA Linnaeus (Lat., balaena, from Gr., φάλαινα, whale.)

1372. **B. mysticetus** Linnaeus. Bowhead Whale. Whalebone black. In Arctic Seas. The most valuable of all whales, reaching a length of 60 feet, yielding 200 to 300 barrels of oil and 1 to 2 tons of whalebone. (Gr., μύστις, mystic; κῆτος, whale.)

Order LXIV. PRIMATES (The Anthropoid Mammals)

Both limbs nearly or quite outside of the common integument of the body; fingers and toes usually 5, the thumb sometimes wanting, when present opposable to some of the others; great toe with a depressed nail; teeth various,

usually with distinct incisors, canines, and molars; clavicles completely developed; shoulders distinct, well separated; brain large; the cerebrum and cerebellum often highly developed; parts of the brain well differentiated. Mammae pectoral, except in some lemurs. A large and varied order, the highest among animals, comprising men, apes, monkeys (of two main types, Asiatic or Catarrhine and American or Platyrrhine), and lemurs. The lemurs diverge in many respects from the other primates, and may well stand as a separate order (*Prosimii*). The structural peculiarities of man are not numerous, and are mostly correlated with the great development of the brain, its enhanced functions constituting the chief peculiarity characteristic of the *Hominidae*. Recent writers, on a basis of anatomy alone, are disposed to place all the anthropoid apes, the chimpanzees (*Pan*), the gibbons (*Hylobates*), the Orangutans (*Simia* or *Pongo*), and the gorillas (*Gorilla* and *Pseudogorilla*) in the same family with man (*Hominidae*). More usually three families or subfamilies are recognized: *Hylobatidae* for the gibbons, *Simiidae* for the other apes, and *Hominidae* for man.

Families of Primates

Cranium very large; hair on body little developed, except in certain specialized areas; body erect in locomotion; great toe not opposable; dentition i. $\frac{2}{2}$; c. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{3}{3}$; on each side; no natural gaps between the teeth. . . . . HOMINIDAE, CCLIX.

FAMILY CCLIX. HOMINIDAE (THE MEN)

The most prominent characters of the *Hominidae* are derived from the distribution of hair on the body, which is subject to wide modification in the different races, from the fact that locomotion is easiest in the erect posture, owing to the relative shortness of the arms (and length of the legs), from the greater length and mobility of the thumb and the comparative immobility of the great toe. Well-marked skeletal peculiarities are the possession of 12 rib-bearing vertebrae, the rounded skull in which the muscular ridges are little prominent, and the great capacity of the cranium. This is, of course, in adaptation to the relatively enormous development of the cerebral hemispheres, which much exceed in bulk those of other primates and to which man owes his specific name. It is apparent that different races have arrived at different stages of evolution in the development of the brain, "as well as in the employment of articulate speech, to which man owes the power of transmitting to others the results of his experience and his position as the 'highest animal.'" As usually understood, this family contains but a single living species, cosmopolitan and highly variable together with certain fossil, more or less ape-like, forms.

836. HOMO Linnaeus (Lat., man)

1373. **H. sapiens sapiens** Linnaeus. MAN. This genus is now split up into many subspecies or races, the native man of this continent, or "American

Indian," being **H. s. americanus** Linnaeus. Other races now naturalized in America are the Caucasian race, **H. s. europaeus** Linnaeus; the Mongolian race, **H. s. asiaticus** Linnaeus; and the Negro race, **H. s. afer** Linnaeus. Subsp. *europaeus* is an immigrant from Europe, the second from Asia, and the third was brought hither from Africa by representatives of subsp. *europaeus*, to be used as slaves. **H. s. americanus** is doubtless an offshoot from *asiaticus*. *Afer*, *europaeus*, and perhaps other groups not binomially named, might be regarded as distinct species, all derived from the hypothetical *Homo sapiens*. The wild man, or typical subsp. *sapiens*, as described by Linnaeus ("*Homo diurnus; varians cultura, loco tetrapus, mutus, hirsutus*"), seems now to be extinct. (Lat., knowing.)

"*Sic vivimus ut immortales et morimur ut mortales.*" (*Seneca.*)

GLOSSARY

Abdomen. Belly.

Abdominal. Pertaining to the belly; said of the ventral fins of fishes when inserted considerably behind the pectorals, the pelvic bones to which the ventral fins are attached having no connection with the shoulder girdle.

Abortive. Remaining or becoming imperfect.

Acuminate. Tapering gradually to a point.

Acute. Sharp-pointed.

Adipose fin. A peculiar, fleshy, fin-like projection behind the dorsal fin, on the backs of Salmons, Catfishes, etc.

Adult. A mature animal.

Aegithognathous. Having the peculiar palate of Passerine birds.

Air bladder. A sac filled with air, lying beneath the backbone of fishes, corresponding to the lungs of the higher vertebrates.

Allantois. Respiratory organ of the embryo.

Altrices. Birds hatched in an immature condition, reared in the nest and fed by the parents.

Alula. The feathers attached to the "thumb" (rather the "index finger") of a bird.

Alveolar surface. A portion of the jaw of a turtle, where the teeth-sockets (alveola) are developed in other reptiles.

Amnion. Protective envelope of the embryo.

Amphicoelian. Double-concave; said of vertebrae.

Anadromous. Running up; said of marine fishes which run up rivers to spawn.

Anal. Pertaining to the anus or vent.

Anal fin. The fin on the median line, behind the vent, in fishes.

Anal plate. The plate, immediately in front of the vent, in serpents, often divided in two by a median suture.

Anchylosed. Grown firmly together.

Anteorbital plate. The plate (1 or 2) in front of the eye in serpents, with its longest diameter vertical; also called preocular.

Antrorse. Turned forwards.

Anus. The external opening of the intestines; the vent.

Arboreal. Living in trees.

Arciferous. Said of the pectoral girdle of toads, the elements overlapping below.

Arterial bulb. The muscular swelling, at the base of the great artery, in fishes.

Articulate. Jointed.

Artiodactylous. Even-toed (toes 2 or 4).

Asterospondylous. Having the hard parts of each vertebra radiating from the central axis, as in most sharks.

Atrophy. Non-development.

Attenuate. Long and slender, as if drawn out.

Auricle. The large lobe of the external ear; also, one of the chambers of the heart.

Azygos (plate). Unpaired; said of a plate behind the rostral on some snakes.

Barbel. An elongated fleshy projection, usually about the head, in fishes.

Basal. Pertaining to the base; at or near the base.

Basipterygoid. Bones developed in the palatine arch in some birds.

Bathybial. Living in the depths of the sea.

Beak. The bill of birds, or (in other animals) any beak-like structure.

Bend of Wing. Angle at the carpus when the wing is folded.

Bicolor. Two-colored.

Bicuspid. Having 2 points.

Booted. Said of the tarsus in birds, when its scales coalesce and form a continuous envelope, as in the robin.

Branchiae. Gills; respiratory organs of fishes.
Branchial. Pertaining to the gills.
Branchihyals. Small bones at base of gill arches.
Branchiostegals. The bony rays supporting the branchiostegal membranes, under the head of a fish, below the opercular bones, and behind the lower jaw.
Bristle. A stiff hair, or hair-like feather.
Buccal. Pertaining to the mouth.
Caducous. Falling off early.
Caecal. Of the form of a blind sac.
Caecum. An appendage of the form of a blind sac, connected with the alimentary canal.
Calcareous. Containing or composed of carbonate of lime.
Canines. The teeth behind the incisors, — the "eye-teeth;" in fishes any conical teeth in the jaws, longer than the others.
Carapace. The upper shell of a turtle, usually composed of bony plates covered by horny scales.
Cardiform (teeth). Teeth coarse and sharp, like wool-cards.
Carinate. Keeled; having a ridge along the middle line.
Carnivorous. Flesh-eating.
Carotid. The great artery running to the head.
Carpus. The wrist.
Caudal. Pertaining to the tail.
Caudal fin. The fin on the tail of fishes and whales.
Caudal peduncle. The region between the anal and caudal fins in fishes.
Cavernous. Containing cavities, either empty or filled with a mucous secretion.
Cephalic fins. Fins on the head of certain rays; a detached portion of the pectoral.
Cere. Fleshy, cutaneous, or membranous covering of the base of the bill in certain birds, particularly the Owls, Hawks, and Parrots.
Cervical. Pertaining to the neck.
Cheek. Space below the eye.
Chiasma. Crossing of the fibers of the optic nerve.
Chin. The space between the rami of the lower jaw.
Chordate. Having a notochord.
Ciliated. Fringed with eyelash-like projections.
Cirri. Fringes.
Claspers. Organs attached to the ventral fins in the male of sharks, skates, etc.
Clavicle. The collar bone, or lower anterior part of shoulder girdle, not entering into socket of arm.
Cloaca. A common opening of genital, urinary, and alimentary canals.
Commissure. The line on which the mandibles of a bird are closed.
Compressed. Flattened laterally.
Condyle. Articulating surface of a bone.
Conirostral. Said of a bill like that of a Sparrow; conical in form and with the commissure angulated basally.
Coracoid. The principal bone of the shoulder girdle in fishes; otherwise a bone or cartilage on the ventral side, helping to form the arm socket.
Costal folds. Folds of the skin (of a Salamander) showing the position of the ribs (costae).
Costals. Lateral plates of a turtle.
Coverts. Small feathers hiding the bases of quills.
Cranium. The brain case.
Crest. In birds, any lengthened feathers about the head; elsewhere, any elevated or crest-like projection.
Crissum. The under tail coverts, in birds.

Ctenoid. Rough-edged; said of scales of fishes when the posterior portion is minutely spinous.
Culmen. The middle line or ridge of the upper mandible in birds.
Cuneate. Wedge-shaped; said of a bird's tail when the middle feathers are longest and the rest regularly shorter.
Cusp. A projection as the lobe of a tooth.
Cycloid. Smooth-edged; said of scales not ctenoid, but concentrically striate.
Cyclospondylous. Having the calcareous laminae of the vertebrae arranged in one ring about a central axis, — said of certain sharks.
Deciduous. Temporary; falling off.
Decurved. Curved downward.
Dentary. The principal or anterior bone of the lower jaw, usually bearing the teeth.
Dentate. With tooth-like notches.
Denticle. A little tooth.
Dentirostral. Having the bill notched near its tip, as in most insect-eating birds.
Depressed. Flattened vertically.
Depth. Greatest vertical diameter (usually of the body of fishes); stated as a proportion in length to base of caudal.
Dermal. Pertaining to the skin.
Desmognathous. United palate, as in the lower water birds (Loons, Gulls, etc.).
Dextral. Right-handed; said of the eyes of a flounder.
Diaphanous. Translucent.
Diaphragm. Muscular septum between thorax and abdomen.
Diapophysis. Transverse process of a vertebra.
Dichromatic. Having two color phases.
Digitigrade. Walking on the toes, like a dog.
Distal. Remote from point of attachment.
Diurnal. Active by day.
Dorsal. Pertaining to the back.
Dorsal fin. The fin on the back of fishes.
Emarginate. Slightly forked or notched at the tip; abruptly narrowed or notched toward the tip; said of quills.
Endoskeleton. The skeleton proper (the inner bony framework of the body).
Epignathous. Upper mandible hooked over tip of lower.
Erectile. Susceptible of being raised or erected.
Eustachian tubes. Tubes connecting the inner ear with the pharynx.
Even (tail). Having all the feathers of equal length.
Exoskeleton. Hard parts (scales, scutes, feathers, hairs) on the surface of the body.
Exserted. Projecting beyond the general level.
Extralimital. Beyond the limits (of this book).
Facial. Pertaining to the face.
Falcate. Scythe-shaped; long, narrow, and curved.
Falciform. Curved, like a scythe.
Fauna. The animals inhabiting any region, taken collectively.
Femoral. Pertaining to the femur, or proximal bone of the hinder leg.
Fibula. The small outer leg bone.
Filament. Any slender or thread-like structure.
Filiform. Thread-form.
Fissirostral. Having the bill very deeply cleft, beyond the base of the horny part, as in the Swallows.
Fontanelle. An unossified space on top of head covered with membrane.
Foramen. A hole or opening.
Forehead. Frontal curve of head.
Forficate. Deeply forked; scissors-like.

Fossae (nasal). Grooves in which the nostrils open.
Fossorial. Adapted for digging.
Frontal bone. Anterior bone of top of head.
Frugivorous. Fruit-eating.
Fulcra. Rudimentary spine-like projections extending on the anterior rays of the fins of ganoid fishes.
Fulvous. Reddish buff.
Furcate. Forked.
Fuscous. Dusky.
Fusiform. Spindle-shaped; tapering toward both ends but rather more abruptly forward.
Ganglion. A nerve center.
Ganoid. Scales or plates of bone covered by enamel, as in the Gar Pike.
Gape. Opening of the mouth.
Gastrosteges. Band-like plates along the belly of a serpent; ventral plates.
Gills. Organs for breathing the air contained in water.
Gill arches. The bony arches to which the gills are attached.
Gill clefts. Same as gill openings.
Gill openings. Openings leading to or from the gills.
Gill rakers. A series of bony appendages variously formed along the inner edge of the anterior gill arch.
Glabrous. Smooth.
Glottis. The opening into the trachea from the pharynx.
Gonys. The middle line of the lower mandible.
Gorget. Throat patch of peculiar feathers.
Graduated (spines). Progressively longer backward; the 3d being as much longer than 2d as second is longer than first.
Graduated (tail). One in which the outer feathers are regularly shorter from the middle.
Granulate. Rough with small prominences.
Gular. Pertaining to the *gula*, or upper fore neck.
Hæmal spine. The lowermost appendages of each vertebra, in fishes.
Haemopophyses. Appendages on the lower side of vertebrae, in fishes.
Hallux. The great toe, — in birds, the hind toe.
Height. Vertical diameter in fishes used as identical with depth.
Heterocercal. Said of the tail of a fish, when unequal, — the backbone more or less evidently running into the upper lobe.
Hibernate. To be torpid in winter.
Hirsute. With shaggy hairs.
Homocercal. Said of the tail of a fish when not evidently unequal, the backbone apparently stopping at the middle of the base of the caudal fin.
Homologous. Of fundamental resemblances, of like origin.
Humerus. Bone of the upper arm.
Hyoid. Pertaining to the tongue.
Hypognathous. Having the lower mandible longer than the upper, as in the Black Skimmer.
Imbricate. Overlapping, like shingles on a roof.
Imperforate. Not pierced through.
Inarticulate. Not jointed.
Incisors. The front or cutting teeth.
Infraoral. Below the mouth.
Interfemoral membrane. The membrane connecting the posterior limbs of a bat including base of tail.
Interhaemals. Bones to which anal rays are attached in fishes.

Intermaxillaries. The premaxillaries; the bones forming the middle of the front part of the upper jaw, in fishes.

Internasals. Plates on the forehead of the snake on the line connecting the two nostrils.

Interneurals. Bones to which dorsal rays are attached in fishes.

Interopercles. Membrane bone between the preopercle and the branchiostegals.

Interorbital. Space between the eyes.

Interspinals. Bones to which fin rays are attached (in fishes); inserted between neural spines above and haemal spines below.

Isocercal (tail). Last vertebrae progressively smaller and ending in median line of caudal fin, as in the Codfish.

Isospondylous. Having the vertebrae similar, the anterior not modified.

Isthmus. The space between the gill clefts in fishes.

Jugular. Pertaining to the lower throat, — said of the ventral fins, of fishes when placed in advance of the attachment of the pectorals.

Keeled. Having a ridge along the middle line.

Labials. Plates on the lip of a serpent.

Lamellae. Plate-like processes inside of the bill of a duck.

Lamellate. Said of a bill provided with lamellae, as in a duck.

Larva. An immature form, which must undergo change of appearance before becoming adult.

Lateral. To or towards the side.

Lateral line. A series of muciferous tubes forming a *raised line* along the sides of a fish, the function sensory.

Laterally. Sidewise.

Lobate. Furnished with membranous flap; said of the toes of birds.

Longitudinal. Running lengthwise.

Loral plate. Plate between eye and nostril of a serpent, before and below preocular when this is present.

Lores. Space between eye and bill of a bird.

Lunate. Form of the new moon; having a broad and rather shallow fork.

Mammary glands. Glands secreting milk.

Mandible. Under jaw (or in birds, either jaw).

Mastoid. Region behind the ear.

Maxilla. Upper jaw.

Maxillaries. Outermost or hindmost bones of the upper jaw, in fishes they are joined to the premaxillaries in front, and usually extend farther back than the latter.

Membrane bone. One formed within the skin and not part of the original skeleton, as the opercles in fishes.

Metacarpus. The hand proper, exclusive of the fingers.

Metamorphosis. A decided change in form.

Metatarsus. Bones of the foot proper.

Molars. The grinding teeth; posterior teeth in the jaw.

Monogamous. Pairing; said of birds.

Muciferous. Producing or containing mucus.

Myocomma. A muscular band, marked in lampreys by cross-furrows.

Nape. Upper part of neck, next to the occiput.

Nares. Nostrils, anterior and posterior.

Nasal. Pertaining to the nostrils.

Nasal plate. Plate in which the nostrils are inserted.

Naso-labial groove. The groove (in a Salamander) running from the center of the upper lip over the top of the nose.

Neural spine. The uppermost spine of a vertebra.

Nictitating membrane. The 3d or inner eyelid which moves across the eyeball; found in some birds, sharks, etc.
Nocturnal. Active by night.
Notochord. A cellular cord, which in the embryo precedes the vertebral column.
Nuchal. Pertaining to the nape or *nucha.*
Obsolete. Faintly marked; scarcely evident.
Occipital. Pertaining to the occiput or back of the head.
Occipital condyle. The part of the skull which forms a joint with the backbone.
Occipital plates. Plates on the head of a serpent, behind the vertical plate.
Occiput. Back of the head.
Ocellate. With eye-like spots, generally roundish and with a lighter border.
Oid (*suffix*). Like; as *Percoid*, perch-like.
Opercle, or *operculum.* Gill cover; the posterior membrane bone of the side of the head, in fishes.
Opercular bones. Membrane bones of the side of the head, in fishes.
Opercular flap. Prolongation of the upper posterior angle of the opercle, in Sunfishes.
Opisthocoelian. Concave behind only; said of vertebrae which connect by ball and socket joints.
Orbicular. Nearly circular.
Orbit. Eye socket.
Oscine. Musical; general name for the group of song birds.
Osseous. Bony.
Ossicula auditus. Bones of the ear in fishes.
Ostariophysous. Having the ear connected with the air bladder by a series of bones.
Osteology. Study of bones.
Oviparous. Producing eggs which are developed after exclusion from the body, as in all birds and most fishes.
Ovoviviparous. Producing eggs which are hatched before exclusion, as in the Dogfish, Mosquito Fish, and Garter Snake.
Ovum. Egg.
Palate. The roof of the mouth.
Palatines. Membrane bones of the roof of mouth; one on each side extending outward and backward from the vomer.
Palmate. Web-footed; having the anterior toes full-webbed.
Palustrine. Living in swamps.
Papilla. A small, fleshy projection.
Papillose. Covered with papillae.
Paragnathous. Having the two mandibles about equal in length.
Parasphenoid. Bone of roof of mouth behind the vomer.
Paratoid. A glandular body behind the ear, in Amphibians.
Parietal. Bone of the side of head above.
Pectinate. Having teeth like a comb.
Pectoral. Pertaining to the breast.
Pectoral fins. The anterior or uppermost of the paired fins, in fishes, corresponding to the anterior limbs of the higher Vertebrates.
Pelage. The hair of a Mammal, taken collectively.
Pelagic. Living on the high seas, usually swimming at or near the surface.
Pelvis. The bones to which the hinder limbs (ventral fins in fishes) are attached.
Pentadactylous. 5-fingered or 5-toed.
Perforate. Pierced through; said of nostrils when without a septum.
Perissodactylous. Odd-toed (toes 1, 3, or 5).
Peritoneum. The membrane lining the abdominal cavity.

Phalanges. Bones of the fingers and toes.
Pharyngeal bones. Bones behind the gills and at the beginning of the oesophagus of fishes, of various forms, almost always provided with teeth; usually 1 pair below and 4 pairs above. They represent a fifth gill arch.
Pharyngognathous. Having the lower pharyngeal bones united.
Physoclistous. Having the air bladder closed.
Physostomous. Having the air bladder connected by a tube with the alimentary canal.
Pigment. Coloring matter.
Pineal body. A small ganglion in the brain; a rudiment of an optic lobe, which in certain lizards (and in extinct forms) is connected with a 3d or median eye.
Plantigrade. Walking on the sole of the foot (*planta*) as do men and bears.
Plastron. Lower shell of a turtle.
Plicate. Folded, showing transverse folds or wrinkles.
Plumage. The feathers of a bird, taken collectively.
Plumbeous. Lead-colored, — dull bluish gray.
Pneumatic duct. A duct connecting the air bladder of a fish with the pharynx.
Pollex. Thumb; in birds, the digit which bears the alula, — corresponding to the index finger.
Polygamous. Mating with more than one female.
Post-frontal (plates). The ones before the vertical plate.
Post-orbital. Behind the eye.
Post-temporal. The bone, in fishes, by which the shoulder girdle is suspended to the cranium.
Praecoces. Birds able to run about and feed themselves at once when hatched.
Praecocial. Having the nature of *Praecoces.*
Precoracoid. A portion of coracoid more or less separated from the rest.
Precoracoid arch. An arch in front of the coracoid in most soft-rayed fishes.
Prefrontal (plates). Those in front of post-frontal in reptiles.
Premaxillaries. The bones, one on either side, forming the front of the upper jaw in fishes. They are usually larger than the maxillaries and commonly bear most of the upper teeth. In many fishes they extend along the side excluding the maxillaries from the margin of the jaw.
Premolars. The small grinders; the teeth between the canines and the true molars.
Preocular. Before the eye.
Preopercle. The membrane bone lying in front of the opercle and more or less nearly parallel with it.
Preorbital. The large membrane bone before the eye in fishes.
Primary. Any one of the 10 (or 9) of the large, stiff quills growing upon the pinion or hand bones of a bird; as distinguished from the secondaries, which grow upon the fore arm.
Primary wing coverts. The coverts overlying the bases of the primaries.
Procoelian. Concave in front only; said of vertebrae.
Procurrent (fin). With the lower rays inserted progressively farther forward.
Projectile. Capable of being thrust forward.
Protractile. Capable of being drawn forward.
Proximal. Nearest (i.e., axis of body).
Pseudobranchiae. Small gills developed on the inner side of the opercle, near its junction with the preopercle.
Pterygoids. Bones of roof of mouth in fishes, behind the palatines.
Pubis. Anterior lower part of pelvis.
Pulmonary. Pertaining to the lungs.
Punctate. Dotted with dark points.

Pyloric caeca. Glandular appendages in the form of blind sacs opening into the alimentary canal of most fishes at the *pylorus* or passage from the stomach to the intestine.

Quadrate bone. A bone of the lower jaw in lower vertebrates, joining the cranium.

Quill. One of the stiff feathers of the wing or tail of a bird.

Quincunx. Set of 5 arranged alternately; thus ⁘

Radius. Outer bone of fore arm.

Ray. One of the cartilaginous rods which support the membrane of the fin of a fish. Those not jointed nor branched are known as *spines.*

Rectrices. Quills of the tail of a bird.

Recurved. Curved upward.

Remiges. Quills of the wing of a bird.

Reticulate. Marked with a network of lines.

Retractile. Susceptible of being drawn inward, as a cat's claw.

Retrorse. Turned backward.

Rhachis. Shaft of a quill.

Rhombic. Diamond-shaped.

Rictal. Pertaining to the rictus, as rictal bristles.

Rictus. Gape of the mouth.

Rostral. Pertaining to the snout, as rostral plate.

Rudimentary. Undeveloped.

Ruff. A series of modified feathers, turned forward.

Rugose. Rough with wrinkles.

Sacral. Pertaining to the *sacrum,* or vertebrae of the sacrum.

Saurognathous. Having the peculiar ("lizard-like") structure of the palate found in Woodpeckers.

Scansorial. Capable of climbing.

Scansorial tail. Tail feathers sharp and stiff, as in the scansorial birds (Woodpeckers).

Scapula. Shoulder blade; in fishes, the bone of the shoulder girdle below the post-temporal.

Scapular arch. Shoulder girdle.

Schizognathous. Split palate, as in the Heron and similar birds.

Scute. Any external bony or horny plate.

Scutellate. Provided with scutella; said of the tarsus when covered with broad plates in a regular vertical series, and separated by regular lines of impression.

Scutellum. One of the tarsal plates or scutella.

Secondaries. The quills growing on the fore arm of a bird.

Second dorsal. The posterior or soft part of the dorsal fin, when the two parts are separated.

Sectorial tooth. One of the premolars of carnivora, adapted for cutting.

Semipalmate. Half webbed; having the anterior toes more or less connected at base by a webbing which does not extend to the claws.

Septum. A thin partition.

Serrate. Notched, like a saw.

Sessile. Without a stem or peduncle.

Setaceous. Bristly.

Setiform. Bristle-like.

Shaft. Stiff axis of a quill.

Shoulder girdle. The bony girdle posterior to the head, to which the anterior limbs are attached (post-temporal; scapula, and coracoid or clavicle).

Sinistral. Left handed. In flounders, the eyes and color on the left side.

Soft dorsal. The posterior part of the dorsal fin in fishes, when composed of soft rays.

Soft rays. Fin rays which are articulate and usually branched.
Spatulate. Shaped like a spatula.
Speculum. The transverse band or bands of color on the wings of certain birds, as the ducks.
Sphenoid. Basal bone of skull.
Spine. Any sharp projecting point; in fishes those fin rays which are unbranched, inarticulate, and usually, but not always, more or less stiffened.
Spinous. Stiff or composed of spines.
Spinous dorsal. The anterior part of the dorsal fin when composed of spinous rays.
Spiracles. Openings in the head or neck of some fishes and amphibians, admitting passage of water of respiration.
Spiral valve. A spiral fold in the intestines in sharks and other relatively primitive fishes.
Spurious. Said of the first primary when less than about ½ the length of the second. (The student will notice that in *Oscines* the *presence* of a short or spurious quill indicates 10 primaries; its *absence*, 9.)
Stellate. Star-like; with radiating ridges, said also of star-like spots.
Sternal fontanelle. A pit at the top of the sternum.
Sternum. The breast bone.
Striate. Striped or streaked.
Sub (in composition). Less than; somewhat; not quite; under, etc.
Subcaudal. Under the tail, said of the plates of snakes.
Subopercle. The bone immediately below the opercles (the suture connecting the two often hidden by scales).
Suborbital. Below the eye.
Suborbital stay. A bone extending from one of the suborbital bones in certain fishes, across the cheeks, to or towards the preopercle.
Subulate. Awl-shaped.
Suffrago. Heel joint; joint of tibia and tarsus.
Sulcate. Furrowed.
Superciliary. Pertaining to the region of the eyebrow.
Supplemental maxillary. A small bone lying along upper edge of the maxillary in certain fishes.
Supra-occipital. The bone at posterior part of skull in fishes, usually with a raised crest above.
Supra-oral. Above the mouth.
Supra-orbital. Above the eye.
Supra-scapula. The post-temporal or bone by which the shoulder girdle in fishes is joined to the skull.
Suspensory bones. Bones by which the lower jaw, in fishes, is fastened to the skull.
Symphysis. Point of junction of the two parts of lower jaws; tip of chin.
Symplectic. The bone in fishes that keys together the hyomandibular and quadrate posteriorly.
Syndactyle. Having 2 toes immovably united for some distance, — as in the Kingfisher.
Synonym. A different word having the same or a similar meaning.
Synonymy. A collection of different names for the same group, species, or thing; "a burden and a disgrace to science." (*Coues.*)
Tail. In mammals, the vertebrae, etc., posterior to the sacrum; in birds, the tail feathers or rectrices, taken collectively; in serpents, the part of the body posterior to the vent; in fishes (usually), the part of the body posterior to the anal fin. (Often used more or less vaguely.)
Tail coverts. The small feathers overlapping the bases of the rectrices in birds.

Tarso-metatarsus. The correct name for the so-called tarsus of birds; the bone reaching from the tibia to the toes, composed chiefly of the metatarsus, but having at its top one of the small tarsal bones confluent with it.

Tarsus. The ankle bones collectively; in birds, commonly used for the shank bone, lying between the tibia and the toes, the *tarso-metatarsus*. The tarsus is usually naked and covered with scales.

Tectospondylous. Having the calcareous or hard parts of each vertebra in several rings about the central axis, as in rays, etc.

Tectrices. The wing and tail coverts.

Temporal. Pertaining to the region of the temples, or side of the head.

Tenuirostral. Slender-billed.

Terete. Cylindrical and tapering.

Terminal. At the end.

Tertials. The quills attached to the humerus.

Tessellated. Marked with little checks or squares, like mosaic work.

Thoracic. Pertaining to the chest; ventral fins are thoracic when attached immediately below the pectorals, as in the perch, the pelvic bones being fastened to the shoulder girdle.

Tibia. Shin bone; inner bone of leg between knee and heel; this area is feathered in all birds.

Tomium. Cutting edge of the bill.

Totipalmate. Having all 4 toes connected by webbing.

Tragus. The inner lobe of the ear; the lobe opposite the auricle.

Transverse. Crosswise.

Trenchant. Compressed to a sharp edge.

Truncate. Abrupt, as if cut squarely off.

Tubercle. A small excrescence, like a pimple.

Tympanum. Drum of the ear; external in some Batrachia, etc.

Typical. Of a structure the most usual in a given group.

Ulna. The inner or posterior bone of the fore arm.

Unguiculate. Provided with claws.

Ungulate. Provided with hoofs.

Unicolor. Of a single color.

Ultimate. Last or farthest.

Urosteges. The plates underneath the tail of a serpent.

Vent. The external opening of the alimentary canal.

Ventral. Pertaining to the abdomen.

Ventral fins. The paired fins behind or below the pectoral fins in fishes, corresponding to the posterior limbs in the higher vertebrates.

Ventral plates. In serpents, the row of plates along the belly between throat and vent.

Ventricle. One of the thick-walled chambers of the heart.

Versatile. Capable of being turned either way.

Vertebra. One of the bones of the spinal column.

Vertical. Up and down.

Vertical fins. The fins on the median line of the body — the dorsal, anal, and caudal fins — the unpaired fins.

Vertical plate. Central plate on the head of a serpent.

Villiform. Said of the teeth of fishes when slender, equal, and crowded into velvety bands.

Villous. Covered with short hair-like projections.

Viscera. Internal organs of an animal.

Viscous. Slimy.

Viviparous. Bringing forth living young.

Vomer. In fishes, the front part of the roof of the mouth ; a bone lying immediately behind the premaxillaries.

Web. The vane of a feather, on either side of the rhachis or "stem" ; also, used for the membrane connecting the toes in water birds.

Weberian ossicles. A series of small bones joining the ear with the air bladder in carp, catfish and related forms.

Xiphisternum. Tip of the sternum.

Ypsiloid. *Y*-shaped. An ypsiloid cartilage is a *y*-shaped cartilage in front of the pubis in certain families of salamanders.

Zygodactyle. Yoke-toed ; having the toes in pairs, — 2 in front, 2 behind, as in Woodpeckers.

Zygoma. The malar or cheek bone.

APPENDIX

SIGNS AND ABBREVIATIONS USED IN THIS BOOK

Fishes

L. Total length in inches of a well-grown example.
D. Dorsal fin.
2d D. Second dorsal fin.
P. Pectoral fins.
V. Ventral fins.
A. Anal fin.
C. Caudal fin.
B. Branchiostegals.
Vert. Vertebrae. The number is usually divided into abdominal and caudal vertebrae; the latter having the haemapophyses united, forming haemal spines. Thus Vert. 10 + 14, the usual number in typical spinous fishes, means 10 abdominal and 14 caudal vertebrae.
♂ Male.
♀ Female.

Roman numericals used with abbreviations for the fins indicate the number of *spines* or *inarticulate* rays in a fin. *Arabic* numerals indicate the number of *soft rays*. In a fin containing both spines and soft rays, a *comma* (,) separating the numerals indicates that the two kinds of rays are *continuous*, or more or less connected. A *dash* (—) indicates that the two kinds of rays form separate fins. Thus, "D. X, 12," describes a single dorsal fin with 10 spines and 12 soft rays; "D. X — 1, 12," indicates two dorsal fins — the first of 10 spines, the second of 12 soft rays; "D. X — I, 12," would indicate the presence of a single spine in the second dorsal.

The posterior soft ray of the dorsal and anal fins is usually split to the base. It should be counted as *one* ray and not as *two*.

"*Gill rakers* 5 + 15," indicates 5 above and 15 below angle of gill-arch; rudiments not counted. When the number above the angle is uncertain or non-essential, it is indicated as "x."

Lat. l. Lateral line; i.e., the number of scales contained in its course. When the lateral line is obsolete, "lat. l." signifies the number of scales in a row from the head to the base of the caudal fin. Thus, "lat. l. 36" means that there are 36 scales in a row along the sides, from the head to the caudal.

"*Scales* 5–36–10" indicates the presence of 36 scales in the lateral line itself; 5 scales in a vertical series between front of dorsal and lateral line, and 10 scales between lateral line and vent.

In all cases the number of rays or scales, as given in the descriptions, is intended to represent a fair average, and a variation of $\frac{1}{8}$, or even more, in either direction need not surprise the student. Generally the spines and scales are more constant in their numbers than the soft rays, and the fewer of either, the less variable.

Length, as used in proportionate measurements, is distance along the side from tip of snout to end of last vertebra. It *does not include* the caudal fin.

Depth in length. The greatest depth of the body as contained in the distance along the side from the snout to the base of the caudal.

Head in length. The distance from the snout along the cheeks to the extremity of the opercles, as contained in the distance from the snout to the base of the caudal.

Eye in head. Its longitudinal diameter as contained in the length of the side of the head.

As above stated, these measurements, as given in the descriptions, are intended to be the *average* of *living adults*, and must be applied to young specimens or preserved ones with caution.

Young fishes are usually, but not always, more elongate than adults, and the eye is proportionally much larger.

A fin is said to be "*long*" when it has a long base, or is many-rayed. A "*high*" fin is one in which the individual rays are elongated.

Reptiles

U. P. Number of urosteges, or plates below the tail.
V. P. Number of ventral plates, or gastrosteges, in Serpents.
L. Total length in inches.
T. Length of tail in inches.

Birds

L. Length in inches (along back from tip of bill to end of longest tail feather); thus, "L. $7\frac{1}{4}$" means, length $7\frac{1}{4}$ inches.
E. Extent (spread of wing) measured in inches.
W. Length of wing (from bend of closed wing — carpal joint — to tip of longest feather in inches).
T. Length of tail in inches (i.e., *actual* length of the longest tail feather).
B. Length of bill in inches (measured along middle line of culmen to tip of bill).
Hd. Length of head in inches (measured with dividers from base of bill to nape.)
Ts. Length of tarsus in inches (measured in front).
Tcl. Length of middle toe with its claw.

The measurements given in the descriptions are understood to represent a fair *average adult male;* a variation of $\frac{1}{6}$, or more, in *absolute* length is nothing unusual; *relative* lengths, as of wings and tail, are much more constant. To save space I have usually preferred to say "L. 6," to saying "L. $5\frac{1}{2}$ to $6\frac{1}{2}$."

♂ Male.
♀ Female.
Yg. Young.
$>$ More than, longer than, or more than equivalent to.
$<$ Less than, in its various senses.
$=$ Sign of equivalence.

The toes are numbered 1, 2, 3, 4; 1 being the hind toe, or hallux; 2 the inner anterior toe; 3 the middle toe; and 4 the outer toe.

Mammals

L. Length in inches from tip of snout to last vertebra of tail.
T. Length of tail in inches, exclusive of hairs.

i. Incisor teeth.
c. Canines.
pm. Premolars.
m. Molars.

Thus "*i.* $\frac{2}{1}-\frac{2}{1}$" indicates 2 incisor teeth in the upper jaw on each side and 1 on each side in the lower.

"Toes 5–4," indicates that there are 5 toes on each fore foot, and 4 on each hind foot.

SPECIAL NOTES

Use of Parentheses

As authority for names of species in this work, the original describer of the species is alone given.

In case the original combination of genera and specific names is still retained, the name of the author is printed without parentheses. In case, however, the original describer placed the species in question in a genus different from the one here adopted, the author's name is enclosed in parentheses.

Thus "*Corvus corax* Linnaeus" means that Linnaeus placed his species *corax* in *Corvus*, where it still remains.

"*Melanerpes erythrocephalus* (Linnaeus)," indicates that the species (*Picus erythrocephalus* of Linnaeus) is now placed in a genus different from the one in which it originally stood. *Melanerpes* is a modern subdivision of *Picus*, which formerly included all Woodpeckers.

"*Eu.*" indicates that the species in question is also found in Europe.

Subspecies

It will be noted that in this work comparatively little stress is laid on subspecies, which are species in the making, distinguished from "true species" by some degree of intergradation. One reason for this lies in the fact that the typical or first-named forms come mostly from within the limits of the present work, the subspecies occupying regions not so early explored. Among the birds, mammals, and some reptiles, subspecies and other variants have been within our limits very thoroughly discriminated by naturalists, exploring every nook and corner of the United States. But to decide "on general principles" that a given form is so near some other that it must be expected to intergrade with it and is therefore "a subspecies" tends to work confusion. Among fishes subspecies are frequent enough, especially among fresh-water forms; but our streams are far from being completely explored. Among marine animals, subspecies, actually proved to be such, are relatively rare.

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